Professional community and student achievement

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CHAPTER 1.

Introduction

Introduction[1]

Apart from the crucial role of collaboration in getting the organizational tasks done, the concept also opens a window of opportunities for fellow staff members to improve their work performance through processes such as learning from and with one another. In these processes it is necessary to reflect jointly and in a critical manner on the fundamental aspects of the work: its goals, the ways to achieve them, and the organization of the work processes. School organizations are no exception in this respect. But does collaboration indeed help improve a school's performance, and if so, which aspects of the collaboration process are most crucial and for which schools? These questions have been central in this study.

In the specific context of school organizations, the concept of teachers working together has been labeled in many different ways, going from teacher collaboration, communities of practice, learning organizations, teacher networks to professional communities and professional learning communities. This thesis, however, focuses on the clarification of the professional community concept and its relationship with student achievement.

1 Based on Lomos, C., Hofman, R. H., & Bosker, R. J. (in press). The concept of professional community and its relationship with student performance. In S. G. Huber & F. Ahlgrimm. *Kooperation in der Schule [Cooperation in the school].* (Book chapter). Germany: Waxmann.

The development of the professional community concept

The term professional community refers to teachers reflecting jointly on specific educational issues, monitoring one another's classes for feedback, engaging in cooperative practices and agreeing on the school's mission, all with a mutual commitment to student success.

In an attempt to provide an adequate picture of the development of the professional community concept and its multidimensional character and to gain an insight into its operationalization, measurement, and its relationship with student achievement, we will distinguish between three consecutive periods, starting in the 1980s: the *definition phase*, the *operationalization and measurement phase*, and the *implementation and conditions phase*.

The definition phase (1982-1994)

The first phase was a period of delimitation and conceptualization, which started around the 1980s with the work of Little (1982). This research stage included both qualitative and quantitative studies that focused on elaborating the concept of teacher collaboration as a part of school reform (e.g. Little, 1982; Nias, Southworth, & Yeomans, 1989). Little (1982) used the terms *collegiality* and *norms of collegiality* to describe teacher collaboration. Such studies identified important representations of teacher collaboration, such as participating together in selecting instruction materials, giving and receiving help and advice on instruction, goal sharing at the school level, and a shared focus on student learning. Little (1992) added practices such as concrete discussions with fellow teachers about teaching, observing one another's teaching practices and providing meaningful feedback, and collaborating in planning instruction (Little, 1992, in Jackson & Tasker, 2002). In addition, authors like Senge (1990), Block (1993), Galagan (1994) and Whyte (1994) emphasized the importance of supporting the collective involvement of the teaching staff in issues such as development of a shared vision (in Hord, 1997). Furthermore, a number of authors like Newmann, Rutter, and Smith (1989) and Bryk and Driscoll (1988) developed and tested *community indexes*, designed to measure the *sense of community* within schools (Rosenholtz, Bassler, & Hoover-Dempsey, 1986). The research into the relationship between professional community and student achievement has mainly concentrated on successful schools and their specific characteristics, identified as highly colleague-oriented (Little, 1982) and collaborative (Rosenholtz, Bassler, & Hoover-Dempsey, 1986).

At the end of this research period, the term professional community was first circumscribed on the basis of its significance for school improvement and reform (e.g. Little & McLaughlin, 1993; McLaughlin & Talbert, 1993; Siskin, 1994). The following characteristics were associated with the concept of the community in general and that of professional community

in particular: *concrete discussions about teaching with fellow teachers, learning and seeking new ideas, observing one another and providing meaningful feedback on teaching, cooperating in planning instruction, a school level focus on student learning, instructional coordination, and school goal-setting* (Hord, 1997; Siskin, 1994).

The operationalization and measurement phase (1995-2004)

The second research period started around the year 1995 and was characterized by a clear need to operationalize and measure the concept. During this period – until approximately 2004 – publications mainly presented quantitative investigations of the relationship between professional community and student achievement (e.g. Bryk, Camburn, & Louis, 1999; Lee & Smith, 1995, 1996; Louis & Kruse, 1995; Louis & Marks, 1998; Newmann & Wehlage, 1995). Generally, this research period represents the processes of defining as well as operationalizing and measuring the professional community concept, as explained next.
This second research period coincided with the comprehensive school reform movement in the USA, which emerged in the early 1990s and resulted in a large number of reports of both quantitative and qualitative studies. Some of these publications were also focused on the establishment of professional communities within schools and their contribution to the success of school reforms. More specifically, these empirical studies dealt with the relationship between professional community and teacher variables, such as trust, as well as with the issue of successful student performance, whereby sufficient evidence was yielded for the proposition that professional community is an important school level predictor of student success (e.g. King & Newmann, 2001; Mulford & Silins, 2003; Odden, Borman, & Fermanich, 2004; Smylie, Wenzel, et al., 2003; Supovitz, 2002; Supovitz & Christman, 2003; Tighe, Wang, & Foley, 2002; Visscher & Witziers, 2004; Wiley, 2001). More specific, Newmann and Wehlage (1995) found that schools where the professional community principle was commonly applied showed high levels of student achievement for the subjects of mathematics, sciences, and social studies (Newmann & Wehlage, 1995). Lee and Smith (1995, 1996) found that in the schools which had undergone reform measures aimed at introducing elements of professional community, the student achievement levels and academic engagement were higher in domains such as mathematics, reading, history, and science (Lee &Smith, 1995). Also quantitative work of Louis, Marks, and Kruse (e.g. Louis, Marks, & Kruse, 1996; Marks & Louis, 1997; Louis & Marks, 1998) showed that professional community had a positive relationship with students' academic performance in primary and secondary education. In general, it was found that "if schools want to enhance their organizational capacity to boost student learning, they should work on building a professional community that is characterized by shared purpose, collaborative activity, and collective responsibility among staff" (Newmann & Wehlage, 1995, p.37).

Many researchers in this period, such as Talbert and McLaughlin (1994), Louis, Marks, and Kruse (1996), and Bryk, Camburn, and Louis (1999) developed and tested instruments designed to measure the professional community concept.

These efforts resulted in a circumscription of professional community which included the sub-dimensions *reflective dialogue, deprivatization of practice, collaborative activity, shared sense of purpose,* and *focus on student learning.* Furthermore, it was found that in the educational context the term professional community specifically refers to three integrated concepts of school culture, namely *professionalism, learning,* and *community* (Toole & Louis, 2002).

The implementation and conditions phase (2005 - 2009)

The third research period started around the year 2005, when the studies became more concentrated on the organizational set up within schools and the expansion of effective professional communities (e.g. Bolam, McMahon, Stoll, Thomas, Wallace, et al., 2005; Harris & Jones, 2010; Lam, 2005; Ingvarson, Meiers, & Beavis, 2005; Goddard, Goddard, & Tschannen-Moran, 2007; Verbiest, 2011; Wahlstrom & Louis, 2008). In addition, the potential moderation of the association between professional community and student achievement became a topic of particular interest, with studies conducted by researchers such as Ingvarson, Meiers, and Beavis, (2005) or Louis, Dretzke, and Wahlstrom (2010). Issues such as specific arrangements at the school level to facilitate professional communities, for example supportive and shared leadership or professional development programs had already been pointed out in previous research by Hord (1997).

The studies in this research period also dealt with the question how to effectively set up and maintain professional learning communities in different educational contexts (Hipp, Huffman, Pankake, & Olivier, 2008). The measurements used were in this research period specifically adapted to the different set up and development stages of professional communities (e.g. Bolam et al., 2005; DuFour, 2004; Stoll et al., 2006; Stoll & Louis, 2007). Furthermore, a number of review studies were published (e.g. Little, 2006; Stoll, Bolam et al., 2006; Lavié, 2006; Vescio, Ross, & Adams, 2008) which indicated the focus and contribution of researchers on categorizing and clarifying the available theoretical and empirical findings with respect to the professional community concept and its role within schools.

Towards a definition of professional community

During the *operationalization and measurement research phase*, Kruse, Louis, and Bryk (1995) ''designated five interconnected variables that describe what they called genuine professional communities in such a broad manner that they can be applied to diverse settings'' (Toole & Louis, 2002, p. 249). In most quantitative studies these five sub-dimensions were used to define, operationalize (e.g. Bryk, Camburn, & Louis, 1999; Lee & Smith, 1995; Louis & Kruse, 1995; Louis, Marks, & Kruse, 1996; Louis & Marks, 1998; Newmann & Wehlange, 1995; Supovitz, 2002; Wiley, 2001) and to measure the concept. They were labeled *reflective dialogue, deprivatization of practice* or *feedback on instruction, collaborative activity, shared sense of purpose* and *a collective focus on student learning*. We will give a definition of each of these sub-concepts next, based on Louis and Marks (1998).
Reflective dialogue refers to the extent to which teachers discuss specific educational issues with one another on a professional basis. *Deprivatization of practice* means that teachers monitor one another's classes for feedback purposes. *Collaborative activity* is a temporal measure of the extent to which teachers engage in cooperative practices. *Shared sense of purpose* refers to the degree to which the teachers agree with the school's mission and its operational principles. And finally, *collective focus on student learning* indicates the mutual commitment of teachers to student success.

We used the terms *professional community* and *professional learning community* interchangeably, especially in the *implementation and conditions research phase.* Both terms are ultimately associated with the improvement of student achievement, the *professional learning community* being a broader construct which also includes teachers' learning processes supported by specific school conditions (Stoll & Louis, 2007). In the present thesis, the theoretical focus was on clarifying the concept of *professional community*, but both concepts were taken into consideration when the relationship with student achievement was reviewed in the literature available.

There are also authors who defined and operationalized the professional community concept in a different manner, such as Westheimer (1999). He defined the concept from the social theory perspective, where it is characterized by shared beliefs, interaction and participation, interdependence, concern for individual and minority views, and a focus on meaningful relationships, collegiality and collaboration. In addition, other authors, such as Wenger (2000) introduced the "communities of practice" concept, as communities that share cultural practices focused on collective learning. In addition, Lieberman (2005) referred to the phenomenon of "networks" with external organizations or teachers.

The distinction is that professional community is a characteristic of teachers' work within schools, focused mainly on students' learning, rather than on organizational learning (Leithwood, Leonard, & Sharratt, 1998).

Professional community in secondary schools

The school-based professional community practice seems to be limited in secondary schools (De Lima, 2001; Talbert, 1991); it is generally more often regarded as a characteristic of elementary schools (Louis & Marks, 1998). In secondary schools, teachers tend to organize their work in departments based on the subjects they teach (Grossman & Stodolsky, 1994; Lee & Smith, 1996; Little, 2002; McLaughlin & Talbert, 2001; Morton, 1993; Sleegers, Van den Berg, & Geijsel, 2000; Talbert, 1993). These departments are considered to be "the most common unit for organizing secondary school teaching" (Busher & Harris, 1999, p.312) and serve as the main point of reference of their staff's teaching beliefs, knowledge, and practice (Burn, Childs, & McNicholl, 2007). However, also in the case of secondary schools, there appears to be a close connection between successful school reforms (Little, 2002), increased student achievement levels (Louis & Marks, 1998), and school-wide professional communities (Toole & Louis, 2002). This finding has raised the question at which level the effective professional community functions and should function in secondary schools: at the school or at the departmental level?

Problem statement and research questions

Given the theoretical and empirical evidence introduced and taking into consideration the claims of many authors that the theories on teacher communities have as yet not been sufficiently conceptualized (Westheimer, 1999), while there is still no proper definition of the professional community concept (Hord, 1997), our *first research aim* was to formulate a universal definition of the concept. Next, considering the different uses and interpretations of the concept in the last three decades, another demanding task would be its measurement. Therefore, our *second research aim* was to validate an instrument for measuring the professional community concept. To continue, considering the status difference between vocational and academic teachers (Morton, 1993), the physical separation (Morton, 1993) between teachers as a result of different school locations and the solitary nature of teaching (Lee & Smith, 1996), the research evidence on the presence and the relationships of professional communities in secondary schools has been difficult to grasp and summarize. So our *third research aim* was to clarify the relationship between professional community and student achievement based on previous empirical evidence, and to produce additional evidence by testing the same effects in the Dutch educational context. Considering the departmentalized structure of secondary schools previously mentioned (McLaughlin & Talbert, 2001; Sleegers, Van den Berg, & Geijsel, 2000), the effect of both department- and

school-based professional community was tested in secondary schools in the present thesis. Based on these aim statements, three main research questions were formulated for this dissertation:

1. How is the concept of professional community defined and operationalized?
2. How can the concept and its sub-dimensions be measured and validated?
3. Does professional community have a relationship with student achievement in secondary schools?

These research questions will be dealt with in Chapter 2, Chapter 4, and Chapters 2, 3, and 5, respectively.

Overview of the dissertation

Chapter 2 presents a literature overview of publications on the professional community concept and empirical evidence of its relationship with student achievement. Next, we will examine the hypothesis that professional communities in secondary schools are ultimately and directly related to student achievement by means of a meta-analysis. After a comprehensive review of multiple articles and research reports, based on theoretical and methodological selection criteria, five studies were considered for this first analysis, which was guided by the following research questions: 1) How has the concept of professional community been defined and operationalized? 2) Does the previous empirical research support the hypothesis that professional community is positively and significantly related to student achievement in secondary schools? 3) What is the summary effect size?

One of the findings of the meta-analysis in Chapter 2 refers to the multidimensionality of the professional community concept, which means that some studies have measured the concept by using several sub-dimensions as separate predictors (Bolam et al., 2005), while other studies grouped the sub-dimensions under one composite or one general index (Louis & Marks, 1998). This feature made us decide to investigate in subsequent studies the influence of professional community on the level of student achievement by using both the five sub-dimensions as separate predictors and the total overarching concept as one scale. Furthermore, our meta-analysis confirmed the proposed relationship between department / school-based professional communities and student achievement, an outcome which will be dealt with in more detail in the next chapters. Finally, another outcome of the meta-analysis was the need for more studies in which multilevel research designs are employed (Reynolds, Sammons, de Fraine, Townsend, & van Damme, 2011).

Chapter 3 investigates the strength of department-based professional communities in Dutch secondary schools and its relationship with student achievement, using a multilevel research design addressing student, teacher, and school-level characteristics (Bosker & Scheerens,

1994). Using secondary data analysis of the TIMSS 2003 data set, we used a research sample of 130 mathematics teachers in 130 Dutch secondary schools. Next, the relationship between mathematics department-based professional communities and the achievement scores of 2,706 students was explored. To this end, the relationship between each of the five interconnected professional community sub-dimensions and these scores was investigated. In addition, we created school clusters based on the particular scores on each of the five sub-dimensions. In this context, the following research questions were addressed: 1) Do teachers from mathematic departments work in professional communities? 2) Are schools with a higher frequency of professional community practices significantly associated with successful schools in terms of student achievement?

Earlier on we indicated that more empirical evidence was necessary to determine whether the different characteristics of the professional community concept could be measured as separate sub-dimensions and subsequently be integrated in one overarching concept. Therefore, Chapter 4 presents the process of selecting and validating the most suitable instrument for measuring the professional community concept. We tested both approaches in our research sample of Dutch secondary schools. During our comprehensive review of available measurement tools developed in the last three decades, we found more than 60 articles that referred to such instruments. Eight instruments were analyzed in detail before selecting the one suitable to be validated. To this end we performed first- and second-order confirmatory factor analyses on data from two stratified subsamples of 102 and 95 teachers. More specific, the following general research questions were formulated: 1) Could a multidimensional reliable instrument also be successfully validated in a different educational context? 2) Would such an instrument have satisfactory psychometric properties so it could be used in future research?

Previous empirical studies have indicated that the school-wide professional community approach promotes successful school reform (Borman & Fermanich, 2004) and student achievement (Newmann & Wehlage, 1995). Therefore, Chapter 5 deals with our *third research question* referring specifically to the presence of school-based professional communities and its association with student attainment. To test whether or not this is the case in different types of secondary schools, we used a sample of 41 schools with 157 teachers and 7,293 students. Furthermore, in this final stage of our thesis research we explored the relationship between the multidimensional concept of professional community and student achievement in a more in-depth manner: first by looking into its separate sub-dimensions and second by using the overarching concept as one scale. In this context we formulated the following research questions: 1) Do Dutch secondary schools function as professional communities? 2) Is school-based professional community related to student achievement?

Finally, Chapter 6 summarizes the findings of the studies dealt with in this thesis. To conclude, we will discuss the limitations of this thesis as well as its implications, and offer some recommendations for future research and practice.

CHAPTER 2.

Professional communities and student achievement – a meta-analysis

Professional communities and student achievement – a meta-analysis[1]

Abstract

In the past 3 decades, the concept of professional community has gained considerable momentum in the theoretical and empirical studies in this field. At the same time, the concept has faced conceptual and methodological difficulties in that as yet no universal definition has been formulated and that its operationalization differs in the various empirical studies conducted on the subject. This study presents a comprehensive synthesis of the theories currently available and their implications for the conceptualization and operationalization of the professional community concept including a meta-analysis of the studies that investigated the effect of professional community on student achievement. Our meta-analysis reported a small but significant summary effect (d = .25, p <.05), indicating that within a school environment professional community could enhance student achievement. Furthermore, the need for the conceptual and empirical validation of the concept's key sub-dimension was discussed.

Keywords: professional community; meta-analysis; secondary education; student achievement

1 Based on Lomos, C., Hofman, R. H., & Bosker, R. J. (2011a). Professional community and student achievement – a meta-analysis. *School Effectiveness and School Improvement, 22(2), 121-148.*

Introduction

The studies on the concept of professional community and its relationship with student achievement conducted in the last 3 decades have produced mixed results (e.g., Goddard, Goddard, & Tschannen-Moran, 2007; Louis & Marks, 1998; Newmann & Wehlage, 1995; Smylie & Wenzel, 2003).

Authors generally agree that an initial challenge in this field of research is a conceptual one (Toole & Louis, 2002), namely the difficulty of specifying a definition of the concept that fits the different theoretical perspectives (Croninger & Malen, 2002). Many scholars have criticized the broad spectrum of the concept (e.g., DuFour, 2004; Furman-Brown, 1999; Toole & Louis, 2002; Westheimer, 1999), as well as the weak elaboration of the ''community'' notion as one of its basic underlying constructs. Moreover, the concept of professional community needs to be properly operationalized, especially because of its association with notions of teacher collaboration and teacher networks. In an initial and simplified attempt to conceptualize it, it has been argued that teachers form part of a professional community when they *share a common view on the school's mission, mutually reflect on instructional practices, cooperate, engage in reflective dialogue, and provide one another with feedback on teaching activities, all with a focus on student learning* (e.g., Bryk, Camburn, & Louis,1999; Grossman, Wineburg, & Woolworth, 2001; Lee & Smith, 1996; Louis & Kruse, 1995; Louis & Marks, 1998; McLaughlin & Talbert, 2001; Rosenholtz, Bassler, & Hoover-Dempsey, 1986; Wahlstrom & Louis, 2008).

Next, the current empirical evidence on the relationship between professional community and student achievement is also diverse. The research studies published in the last decade have either investigated the characteristics of professional community based on qualitative designs (e.g., Little, 1982; McLaughlin & Talbert, 1993) or examined its relationships and effects by performing quantitative analyses (e.g., Bryk, Easton, Kerbow, Rollow, & Sebring, 1994; Louis & Kruse, 1995; Louis, Marks, & Kruse, 1996).

In sum, this research has addressed the concept of professional community, trying to clarify its relationship with student achievement by, firstly, reviewing the literature, secondly, performing a meta-analysis, and finally, discussing the results obtained. It has generally been accepted that the ultimate goal of any ongoing process or change in education is to affect student performance in a positive manner. Although Stoll et al. (2006a) and Louis (2006) have underlined the idea that the importance of professional community is ultimately related to the improvement of student achievement, we suggest that this view should be more thoroughly investigated (Spillane & Louis, 2002).

Conceptual framework

The concept of professional community

As indicated before, the concept of professional community has been difficult to define and measure because of the different theoretical perspectives on this notion and the complexity of its applications in the context of day-to-day practice (Stoll & Louis, 2007). Toole and Louis (2002) have pointed at the struggle of many different authors to make sense of the concept; some of them claim that the theories on teacher communities are under conceptualized (Westheimer, 1999) or find that they do not provide sufficient guidance for practice (Furman-Brown, 1999). In addition, Cranston (2007) mentions that the professional learning community has no proper universal definition (Hord, 1997), arguing that there are as many definitions of the notion as authors who write about it (Plank, 1997).

After analyzing the literature, we are able to present a number of possible explanations why the professional community concept is so difficult to grasp, both conceptually and methodologically.

First, the professional community aspect of the work of teachers is dealt with from several theoretical perspectives (Fallon & Barnett, 2009). The theoretical perspective most employed is the system-oriented approach to schools as organizations, according to which the structural and cultural sub-dimensions of school workplace environments are linked to professional learning and change. In this view, the term professional community refers to three integrated concepts of school culture, namely *professionalism*, referring to client and knowledge (Darling-Hammond, 1990), which in turn stimulates learning, which is closely related to teachers' inquiry, which may lead to *community-based* behavior, where personal connection has a predominant role (Louis & Kruse, 1995; Toole & Louis, 2002). This perspective is based on the view that the elements *professionalism, learning,* and *community* represent the foundation of the professional community concept. However, the extensive number of interpretations of these sociological concepts, such as community and professionalism, illustrate the difficulty of defining and operationalizing the concept.

Second, the meaning of the term professional community is often generalized, and it has different meanings to different researchers (Beck, 1999; de Lima, 2001). Mostly, it is used to describe any combination of individuals with an interest in education (DuFour, 2004, cited in Cranston, 2007), sharing a set of common ideas and ideals (Sergiovanni, 1994). In addition, apart from referring to the situation of teacher sharing, it also implies the ''establishment of a school-wide culture that makes collaboration expected, inclusive, genuine, ongoing, and focused on critically examining practice to improve student outcomes'' (Toole & Louis, 2002, p. 247).

Third, as pointed out by many authors, such as Toole and Louis (2002), a whole spectrum of different terms has been used in connection with the concept, such as *norms of collegiality* (Little, 1982, 1990), *teachers' collaboration with colleagues* (Bryk & Driscol, 1988; Rosenholtz, 1985, 1991), *professional community* (Louis & Kruse, 1995; Louis & Marks, 1998), *learning community* (McLaughlin & Talbert, 2001), *professional learning community* (Bolam et al., 2005; Corrie & Hargreaves, 2006; DuFour & Eaker, 1998; A. Hargreaves, 2007), and *teacher networks* (e.g., Adams, 2000; Lieberman & McLaughlin, 1992a, 1992b; Lieberman & Wood, 2002a, 2002b; Pennell & Firestone, 1996; Smith & Wohlstetter, 2001). The use of many interrelated concepts underlies the multiple visions of community (Westheimer, 1998) and the attempt of researchers to grasp the collaborative school culture.

However, taking into consideration these difficult grounds, an attempt will be made to offer a short perspective over the development in framing a specific definition of professional community.

First, it appears that *collegiality* and *collaboration* are the basic elements of the earlier designation of collaborative school cultures (Sleegers, Geijsel, & van den Berg, 2002; Staessens, 1993) and professional community (Toole & Louis, 2002), being related to the system-oriented perspective on schools as learning organizations. However, the terms collaboration and collegiality have sometimes been used interchangeably (de Lima, 2001), while D.H. Hargreaves (1995) argued that the presence of collegiality specifically invokes an institutional base and specific structural conditions, which emphasizes the organizational context.

During the 1990s, the concept of professional community was mainly emphasized (Stoll & Louis, 2007). Next, the 1995 school reform movements in the United States[2] have significantly contributed to the definition and operationalization of the professional community concept. This reform was partly aimed at stimulating teachers to work in different forms of professional communities in order to improve student achievement (Newmann & Wehlage, 1995). The changes in the ways of working resulting from the reform led to an increased interest in the evaluation of the effect of professional teacher organizations on student achievement (Newmann & Wehlage, 1995). Furthermore, also the field of quantitative research required a more precise conceptualization of professional community. In this context, Kruse, Louis, and Bryk (1995), building on the previous focus on teacher collaboration and collegiality ''designated five interconnected variables that describe what they called genuine professional communities in such a broad manner that they can be applied to diverse settings'' (Toole & Louis, 2002, p. 249), namely *reflective dialogue, deprivatization of practice or feedback on instruction, collaborative activity, shared sense of purpose,* and a *collective focus on student*

2 For a detailed understanding of the comprehensive school reforms and their effects on student achievement, we recommend the study of Borman, Hewes, Overman, and Brown, (2003).

learning. These variables have been used by different researchers in quantitative empirical studies (e.g., Bryk et al., 1994; Louis & Kruse, 1995; Louis & Marks, 1998; Marks & Louis, 1997; Newmann, Marks, & Gamoran, 1996; Newmann & Wehlage, 1995; Smylie & Wenzel, 2003; Tighe, Wang, & Foley, 2002). For a clear understanding of the five interconnected variables and their possible application to diverse educational contexts, some definitions are required. First, *reflective dialogue* refers to the extent to which teachers engage in professional dialogues about specific educational issues. *Deprivatization of practice* means that teachers observe one another's classes with the aim of giving and receiving feedback. *Collaborative activity* represents a temporal measure of the extent to which teachers engage in cooperative practices. *Shared sense of purpose* refers to the degree to which the teachers agree with the school's mission and its operational principles. And finally, the *collective focus on student learning* indicates the mutual commitment of teachers to student success (Louis & Marks, 1998).

Considering the complexity of the concept of professional community, some authors have introduced additional components or characteristics as key variables to define the concept, to be used either in combination with the five interconnected variables or independently. Examples are *teacher control* (Lee & Smith, 1996), *collective team practices* (Supovitz, 2002), *policy and evaluation* (Visscher & Witziers, 2004), *leadership* (Visscher & Witziers, 2004), *individual or group learning* (Bolam et al., 2005), and others.

In conclusion, the definition and implicit operationalization of the concept of professional community has proven to be a difficult process. A number of quantitative studies have used the five interconnected variables to measure the concept, while other publications have added new characteristics, such as leadership, policy, and evaluation. However, it is important to mention that the definition of professional community based on the five interconnected variables is not the only applicable definition. As indicated before, there are various *visions of community* (Westheimer, 1998) and many *metaphors of educational community* (Beck, 1999). Given this situation, we argue that by looking into the studies that investigate the effect of professional community on student achievement, we could shed some light on the way in which it could be best approached both methodologically and theoretically, also in the context of future empirical research.

Previous studies on the relationship of professional community with student achievement

Given the focus on the concept in the last 2 decades, it was necessary to first look for literature reviews on this topic and map out their findings. There are a number of literature reviews of studies focused on professional community (Alberta Education, 2006; Cormier & Olivier, 2009; Cranston, 2007; Feger & Arruda, 2008; Hord, 1997; Jackson & Tasker, 2002;

Lavie´, 2006; Little, 2006; Stoll et al., 2006a; Vescio, Ross, & Adams, 2008), of which only one is specifically aimed at studies dealing with its association with student achievement. This is the publication by Vescio et al. (2008), which reviews the empirical evidence gathered on the impact of the professional learning community on both teaching practices and student achievement. After evaluating the evidence on the improvement of student achievement, the authors concluded:

> . . . although few in number, the collective results of these studies offer an unequivocal answer to the question about whether the literature supports the assumption that student learning increases when teachers participate in professional learning communities. The answer is resounding and encouraging yes. (p. 87).

We considered the combination of qualitative with quantitative empirical evidence on the improvement of student achievement as presented by Vescio et al. (2008) as not differentiated sufficiently. However, this review formed a starting point for our meta-analysis. In this follow-up study, we present a new approach to reviewing the research sample and determining a summary effect size by taking the conceptual definitions, the measurement instruments, and the research methods used into account.

Professional community in secondary schools

The focus of this meta-analysis is on secondary/high schools, where establishing and maintaining a professional community is determined by many factors, such as the status difference between vocational and academic teachers (Morton, 1993), the physical separation (Morton, 1993), the solitary nature of teaching (Lee & Smith, 1996), the conventional norms (Talbert, 1993), and the presence of the departmentalized organization of schools (Lee & Smith, 1996; Little, 2002; McLaughlin & Talbert, 2001; Morton, 1993; Sleegers, van den Berg, & Geijsel, 2000; Talbert, 1993). Moreover, the presence of professional communities in secondary/high schools is considered limited (de Lima, 2001; Talbert, 1991), being generally a characteristic of elementary schools (Louis & Marks, 1998). However, even in the case of secondary/high schools, there is a close connection between successful school reforms (Little, 2002), increased student achievement levels (Louis & Marks, 1998), and professional communities (Toole & Louis, 2002). In conclusion, if secondary schools would operate as professional communities, improved student learning and achievement levels could be sustained (Cranston, 2007). We wanted to investigate to what degree this premise was confirmed by the empirical studies.

In sum, we performed this meta-analysis by systematically assessing the methodological quality of the studies on the basis of specific criteria, resulting in new evidence on the relationship between the professional community concept and student achievement in secondary/high schools.

Methodology

This in-depth analysis aimed at applying quantitative methods of research and taking an international perspective.

Selection of the studies

In order to find the suitable quantitative empirical research studies on the effect of professional community on student achievement, a systematic and comprehensive search was conducted, based on EBSCOhost, ERIC, and PiCarta[3] documentary databases. Given the fact that these search engines only cover scholarly journals and library books, we continued our search by using GOOGLE Scholar, which enabled us to retrieve online research reports, dissertations, and conference presentations. In addition, all reviews and articles used for the conceptualization part were checked for references to other empirical studies, and all studies selected on this basis were again inspected for any other references that had not yet been covered.

In a first phase of the search, we used the general keywords *professional community, professional learning community, learning organization, organizational learning, learning community,* and *community of instructional practice*. In a second stage, we diversified our search based on the definition of the professional community concept and our specific interest in its relationship with student achievement by adding the keywords *collegiality, subject department, teacher commitment, school organization, reflective dialogue, collaborative practice,* and *student achievement*.

In order to make our database even more substantial, we also reviewed unpublished work, such as dissertations, where there is traditionally more room for the experimental development of theoretical frameworks (e.g., Alberta Education, 2006; Coleman, 2005; Cranston, 2007; Feger & Arruda, 2008; Kullmann, 2009; Maslowski, 2001; Pitman, 2008; Witziers, 1992).

In a third stage, we determined our time frame, which was based on the first official publication on teachers working together in a professional group, a study published in 1982 by Little. Therefore, the year 1982 served as the starting point of our search until 2009. Subsequently, we directed our attention to quantitative empirical research into the effects of professional communities on student achievement. There are several studies on this topic, for example, Bolam et al., (2005); Bryk and Driscoll (1988); Christman (2001); D'Amico, Harwell, Stein, and van den Heuvel (2001); Goddard et al. (2007); Ingvarson, Meiers, and

3 PiCarta is a meta-catalogue of OCLC PICA, which contains titles of books, illustrated magazines, and articles (see http://nl.wikipedia.org/wiki/PiCarta)

Beavis (2005); Kuhlemeier and van den Bergh (2000); Lam (2005); Langer, (2000); Lee and Smith (1996); Louis and Marks (1998); Marks and Louis (1997); Newmann and Wehlage, (1995); Smylie and Wenzel (2003); Supovitz (2002); Tighe et al. (2002); Visscher and Witziers (2004); and Wiley (2001). In addition, we found a number of other studies that investigated the relationship of professional communities with other teacher and school variables, but we were particularly interested in studies dealing with the direct relationship between professional community and student achievement.

After finding the studies that met our general search criteria, we had to decide which ones were suitable for our meta-analysis. To this end, we formulated four main criteria. The first one was that the studies had to be performed on different or *independent data sets*. The second criterion was that the publications in our research sample had to be *focused on secondary education*, for reasons mentioned previously. The third one was that they had to provide *a clear conceptualization* and *operationalization of the professional community concept*. Finally, the fourth criterion was that they had to include *an explicit measure of student achievement* as outcome variable. We identified five studies that met the four selection criteria, and our final research sample for the meta-analysis included the following studies: (1) Bolam et al. (2005), (2) Lee and Smith (1996), (3) Louis and Marks (1998), (4) Supovitz (2002), and (5) Visscher and Witziers (2004).

Criteria for the analysis

Given the distinctions between the five studies, we used conceptual and methodological criteria to analyze the selected articles, a common method used for meta-analyses in the educational field (e.g., Hallinger & Heck, 1998; Witziers, Bosker, & Krüger, 2003). The relevant conceptual criterion was the *concept* used (definition and operationalization). The methodological criteria referred to *sample size*, *type of measurement instrument employed, the validity and reliability of the instrument used, outcome variable* (type of student achievement), *type of statistical modeling technique* (multilevel analysis or not), *the value added* (whether or not the study had been adjusted using covariates at the student level), and *type of effects reported*. All five studies were analyzed based on these conceptual and methodological criteria in order to identify their differences and maximize the clarity and reliability of the meta-analysis results.

Contextual and methodological characteristics of the studies

Before presenting the analysis based on the criteria previously mentioned, a concise description of the five studies is in place.

The country where a study is conducted is a determining factor of the specifics of the educational system, the size of the secondary schools, and the type of student evaluation tests. Further, the interpretation and realization of the professional community concept may differ per country, depending on the institutional context or the specific national educational requirements. In our case, three studies were performed in the United States (Lee & Smith, 1996; Louis & Marks, 1998; Supovitz,2002), one in The Netherlands (Visscher & Witziers, 2004), and one in England (Bolam et al., 2005).

Chronologically, the first study was that of Lee and Smith (1996), focusing on the school restructuring reform movement in secondary schools in the USA. Their research was aimed at investigating if teachers working in professional communities and manifesting collective responsibility for learning in restructuring schools was effective in increasing student achievement. Next, also the study of Louis and Marks (1998) was centered around the question whether professional community, as a feature of restructured schools, affected classroom instruction and student achievement in nationally selected schools in the USA. The third study, that of Supovitz (2002), dealt with another school improvement plan still part of the comprehensive school reform structure, called ‘‘Student first’’, which was implemented between 1996 and 2001 in Cincinnati Public Schools (CPS) (Supovitz, 2002). This study was aimed at measuring the effects of the introduction of team-teaching and group instructional practices, and relating these effects to school culture and student outcomes. Finally, the last two studies substantially differed with respect to their location, context, and aim. The study of Visscher and Witziers (2004), conducted in Dutch secondary schools, explored whether mathematics departments functioning as professional communities would increase student achievement. Their interest in the community-based character of the subject department was motivated by the hypothesis that this type of working unit could be instrumental in the realization of sustainable innovations, better workplace conditions for teachers, and high educational quality standards (Harris, 2001; Harris, Jamieson, & Russ, 1995; Visscher & Witziers, 2004). The last and most recent study in our sample was that of Bolam et al. (2005), which investigated the process of creating and sustaining effective professional learning communities in British schools and their effects on student learning and on the schools as a whole.

Table 1. Conceptualization and operationalization of professional community

Authors	Concept	Conceptualization and operationalization Definition	Operationalization
Lee & Smith (1996)	Professional community	"Developing a professional community in a school requires both deprivatizing practice and increased collaboration among teachers…(p.106); …work life effects defined by collaboration and control, our major focus is on school norms that reflect teachers' attitudes about their students: what we have called collective responsibility for learning" (p.110).	Collective responsibility for student learning Cooperation and support among teachers Teacher control
Louis & Marks (1998)	Professional community	"Five elements of practice typify schoolwide professional community: shared values, focus on student learning, collaboration, deprivatized practice, and reflective dialogue. These elements are not a hierarchy, but their presence distinguishes professional community that is schoolwide from other forms of school cultures" (p.539).	Shared sense or purpose Collaborative activity Focus on student learning Deprivatized practice Reflective dialogue
Supovitz (2002)	Team group instructional practices	"In communities of instructional practice, teacher teams continually explore their curricular and pedagogical strategies and the influences of these efforts on student learning (…) it will maximize their collective knowledge and skills but also facilitate their learning of new knowledge and skills…" (p.1592)	The frequency individual teachers worked with at least one other teacher in their school on instructionally related issues
Visscher & Witziers (2004)	Professional community	"…setting where teachers share values, try to improve instruction, and de-privatize classroom practice…" (p.788)	Consensus Consultation and cooperation Policy and evaluation Decision-making School leadership Departmental leadership
Bolam et al. (2005)	Professional learning community	"An effective professional learning community has the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning" (p.iii)	Shared values and vision Collaboration Collective responsibility for pupil's learning Group and individual learning Reflective professional inquiry

Conceptual criteria

Concept – definition and operationalization

In view of our debate about the conceptualization of professional community, it is important to establish how the five articles have defined and operationalized the professional community concept. As discussed in the theoretical section, the professional community concept is difficult to define and operationalize. This situation is also reflected in our research sample, and Table 1 offers a detailed description of how the concept was defined and operationalized in the different studies.

Four of the five studies explicitly used a similar concept, referring to *professional community* or *professional learning community*, while Supovitz (2002) referred to *team group instructional practices*. Regarding its definition, all five studies have conceptualized professional community on the basis of similar characteristics, like its community level, professionalism, and learning focus. However, the five studies used a variety of operationalizations. More specific, two of these studies, namely those by Bolam et al. (2005) and Louis and Marks (1998), included the five interrelated characteristics of the concept, while Visscher and Witziers (2004) included two of the characteristics and added policy and evaluation, decision making and leadership. Finally, Lee and Smith (1996) included two of the characteristics and added teacher control, and Supovitz (2002) included one of the characteristics to measure the effect of group instructional practices on student achievement (see Table 1 for more explanations). In conclusion, the conceptualization of professional community in these studies has built upon the notions of community, professionalism, and teacher or student learning focus, but measured the concept using a range of operationalizations.

Methodological criteria

Sample size

In order to obtain powerful and reliable results, the selected sample had to be composed of a large number of participants, in our case, schools. The research samples of the five studies in our analysis consisted of varying numbers of schools and students, as presented in Table 2.

More specifically, the samples consisted of 24 schools in the case of Louis and Marks (1998), 39 schools in Visscher and Witziers (2004), 79 schools in the study of Supovitz (2002), 393 in the case of Bolam et al. (2005), and 820 in the case of Lee and Smith (1996). In addition, the number of students varied from 975 (Visscher & Witziers, 2004) to almost 50,000 (Supovitz, 2002).

Considering that the total number of schools formed our data source in the meta-analysis, it is important to clarify what types of schools were used in the studies and the age range of the students involved. Most studies used data from secondary/middle schools and high schools. Bolam et al. (2005) used data from nursery, primary, secondary, and special schools, but we only used the results for the secondary schools in our analysis, which in this study refer to students between 11 and 18 years of age. Supovitz (2002) covered Grades 4 to 8 in middle schools, the sample including students between 9 and 14 years old. The study of Visscher and Witziers (2004), conducted in The Netherlands, also referred to secondary schools but was focused on students of 15 to 16 years old, just as Lee and Smith (1996), whose research sample consisted of eighth and ninth high school grades in the USA and students between 13 and 15 years old. Finally, Louis and Marks (1998) based their analysis on elementary, secondary, and high school data, while controlling for the effects of professional communities in elementary schools.

Type of measurement instrument

All five studies used questionnaires as their method of data collection. Two of the five research teams, namely Bolam et al. (2005) and Louis and Marks (1998), also conducted case studies and interviews and observed classrooms or meetings. These forms of data collection were, however, not relevant to the current analysis.

Validity and reliability of the instrument

As a start, it was important to determine the quality of the instruments used in the five studies for measuring the professional community concept. Furthermore, in order to report reliably of the effects found and calculate the summary effect size, it was important to include data about the internal consistency of the instruments together with aspects of content, criterion, and construct validity (Muijs, 2009). In addition, information related to the level of analysis or settings was also relevant. In order to obtain this knowledge, we made a brief synthesis of the main data in relation to the reliability and validity of the instruments used, which is presented in Table 2.

With respect to scales, subscales, and items employed, we found both similarities and differences within the theoretical frameworks of the instruments. The number of scales employed differed, from one scale in the study of Supovitz (2002) to three in the study of Lee and Smith (1996). The number of items varied as well, from 234 items in the work of Visscher and Witziers to 7 items in the publication of Supovitz (2002). Although the differences in the number of subscales and items would have been interesting to investigate, the deviations in these areas did not negatively influence the reliability of the instrument. Practically all studies reported a sufficient Cronbach a value around .70 or higher, indicating a fair to good

internal consistency. Another important aspect of a measurement instrument is its construct validity, which was satisfactory for all instruments analyzed (see Table 2).

In sum, all instruments met the necessary conditions with respect to reliability, internal consistency, and validity, while the size of the research samples was sufficient.

Table 2. Instruments' validity and reliability

Authors	Data sources Sample sizes	The scales, sub-scales or factors obtained	Instrument /scale	Internal consistency	Criterion and construct validity
Lee & Smith (1996)	Students: 11,692 Teachers: 9,904 Schools: 820	Cooperation and support among teachers Collective responsibility for student learning Teacher control	3 scales 35 items	Cronbach α values for the scales range from .76 to .87	The association between the three measures (p.121) Factor analysis (p.134)
Louis & Marks (1998)	Students: 5,943 Teachers: 910 Schools: 24	Shared sense or purpose Collaborative activity Focus on student learning Deprivatized practice Reflective dialogue	1 scale 5 sub-scales 19 items	Cronbach α = .69 (α values for sub-scales range from .61 to .74)	Authentic pedagogy and social support for achievement (p.549) Factor analysis (p.545)
Supovitz (2002)	Students: < 50,000; Teachers: 2,359 Schools: 79	Group instructional practices	1 scale 7 items	Cronbach α = .90	School culture and instructional practices (p.1604) Confirmatory factor analysis (p.1621)
Visscher & Witziers (2004)	Students: 975 Teachers: 169 Schools: 39	Consensus Consultation and cooperation Policy and evaluation Decision-making School leadership Departmental leadership	6 scales 21 sub-scales 234 items	Cronbach α values for the scales and sub-scales range from .73 to .94	Other related traits of professional community (p.792) Factor analysis (p.791)
Bolam et al.(2005)	Principals: 393 Schools: 393	Professional and pupil learning ethos Within school policy, management and support for professional learning Enquiry orientation (external and internal) Participation of nonteaching staff in professional learning community	4 factors 43 items	Factor analysis α values for the 4 factors > .70	Different phase of education (primary or secondary) (p.34) Type of contexts (p.46) Internal validity (p.45)

Outcome variables

One of the main conditions for selecting the initial five studies was that all contained an explicit measurement of student achievement. As expected, the achievement measures used in these publications were not all the same, as indicated in Table 3. Furthermore, it is important to mention that Table 3 contains the necessary information based on which the scores for the meta-analysis have been computed.

Student achievement scores or students' gain represented the outcome measures. In the measurement of student achievement, Lee and Smith (1996) and Supovitz (2002) applied more complex procedures. First, they replaced the measurement point indicator of student achievement by students' gain scores or progress. Specifically, Lee and Smith (1996) calculated the difference in student achievement between 8th and 10th grade and used this difference as students' gain. Likewise, Supovitz controlled for students' prior achievements and labeled the outcome as students' progress. Both studies provided these scores for reading, mathematics, science, and other disciplines, while performing the analysis separately for each outcome. In contrast, Louis and Marks (1998) used student achievement scores at one measurement point and focused on authentic achievement4 levels in mathematics and social studies. Visscher and Witziers (2004) used national student performance scores for mathematics achievement also at one measurement point. Finally, Bolam et al. (2005) used national student assessment scores in four consecutive stages to calculate the school performance measures and relative student progress. However, they used student performance in the last stage of the assessment, aggregated at the school level to test the effect of professional community on student achievement.

4 Authentic achievement is a special type of measurement of student achievement, which was developed by researchers at the Center on Organization and Restructuring Schools (CORS) in the United States during the comprehensive reforms. Authentic achievement contains multidisciplinary standards, measuring knowledge construction, disciplined inquiry, and value beyond school. It is based on the assumption that achievement in one domain says something about a pupil's intellectual capacities in other domains (Louis & Marks, 1998).

Table 3. Methodological information available

Authors	Outcome variable	Statistical technique	Value added	Effects reported	SE reported	p value reported	Nr of schools
Lee & Smith (1996)	Students' gain in mathematics, reading, science and history	HLM	Yes	ESs coefficients for 1,2 PC scales and gain in mathematics ES_1 = .33 ES_3 = .15	No	.001	820
Louis & Marks (1998)	Authentic student achievement in mathematics and social sciences	HLM	Yes	β = .26	No	.001	24
Supovitz (2002)	Students' progress in mathematics, reading, science, writing, and citizenship	HLM	Yes	β coefficients for Grade 6th outcomes β_1 = .16 β_2 = .09 β_3 = .19 β_4 = .21 β_5 = .11	Yes	. 05 . 10 .001 .001 . 05	23
Visscher & Witziers (2004)	National mathematics' tests performance	HLM	Yes	School variance = .06	Yes	.10	39
Bolam et al. (2005)	National pupil assessment scores and overachievement	Correla-tion	Yes	School-level correlations: with factor 1 =.16 with factor 2 =.18	No	.01	153

Statistical techniques used

Table 3 also indicates the statistical techniques used in the analyses conducted in the five articles under review. In view of the interpretation of the findings of the various studies, it was very important to look at the different types of statistical techniques used to perform the quantitative data analyses.

Four of the five studies applied hierarchical linear modeling to investigate the relationship between professional community and student achievement in secondary schools. After conducting a meta-analysis of the comprehensive reform movements in the United States, Odden, Borman, and Fermanich (2004) concluded that a multilevel statistical research model would be the best instrument for investigating teacher and school effects on student achievement. Moreover, in investigating the predictors of school effectiveness, this model is certainly required because it accounts for the dependence between students within teachers/classes and teachers/classes within schools (Bosker & Scheerens, 1994). In this context, the statistical technique used by Lee and Smith (1996), Louis and Marks (1998), Supovitz (2002), and Visscher and Witziers (2004) was the most appropriate to find the effects of interest. Bolam et al. (2005) performed a correlation analysis to investigate the link between student outcome measures and professional learning communities, reporting partial correlation indices and levels of significance, while controlling for the effects of gender, ethnicity, and socioeconomic status.

Value added

The value added indicates whether the study has accounted for covariates at the student level as important precursors of student achievement. All five studies controlled for student covariates, such as gender or socioeconomic status.

Effects reported

Table 3 also shows that all five studies found a significant relationship between professional communities and student achievement in secondary schools at specific reported *p* levels (see Table 3). However, the studies reported the effects in different ways, such as using effect sizes (Lee & Smith, 1996), β coefficients for different disciplines (Lee & Smith, 1996; Supovitz, 2002), explained school-level variance (Visscher & Witziers, 2004), or school-level correlations (Bolam et al., 2005). These differences in reporting and/or the lack of reporting the standard errors required specific calculations in order to obtain the necessary scores for the meta-analysis, as presented in Appendix 1 (Formulas 1 and 2).

In some cases, the total number of the schools or students that participated in each study is different from the number of schools or students used to test the hypothesis that professional community has a relationship with student achievement. Table 2 presented the total number of participants in each study and Table 3 presents the number of schools used to test the hypothesis.

Results

Necessary calculations for the meta-analysis

The synthesis described above has offered a clear understanding of the conceptual and methodological approaches conducted in the five studies. In order to test the hypothesis that professional community has a significant effect on student achievement in secondary schools, we had to compute the correlation coefficients at the student level for each study, so we could work with the same type of coefficients. Next, given that variance strongly depends on correlation, the student level correlation coefficients had to be transformed into Fisher *Z* units (Borenstein, Hedges, Higgins, & Rothstein, 2009). In sum, the meta-analysis was performed using the corresponding Fisher Z units, *Z* variance, and *Z* standard errors, which were calculated on the basis of the formulas presented in Appendix 1 (Formulas 3, 4, and 5) (Borenstein et al., 2 009). In addition, using the formula presented in Appendix 1 (Formula 6) (Borenstein et al., 2009), we also transformed the correlation coefficient (*r*) into standardized mean differences or Cohen's *d* (Cohen, 1989) with the aim of using this metric as a standardized difference in reporting the effect sizes. A detailed description of how the transformations and calculations were performed for each study to obtain the necessary scores for the meta-analysis is presented in the **Endnotes**.

Table 4 lists the results of these calculations, showing the correlation coefficient at the student level calculated on the basis of the findings reported in the five studies, followed by the corresponding effect sizes indicated by Cohen's *d* (Cohen, 1989). The effect sizes (Cohen's *d*) obtained vary per study, the standardized mean differences ranging from .22 (Lee & Smith, 1996; Visscher & Witziers, 2004) to .56 (Louis & Marks, 1998). Table 4 also includes the Fischer *Z* units and the calculated standard errors required for performing the meta-analysis.

Table 4. Meta-analysis coefficients

Authors	Correlation coefficient at student level r	Effect sizes Cohen's d	Fisher Z	SE_z	95% confidence interval for r
Lee & Smith (1996)	r = .107	d = .216	Z = .107	SE_z = .035	<-.011; .126>
Louis &Marks (1998)	r = .260	d = .558	Z = .266	SE_z = .218	<-.160; .600>
Supovitz (2002)	r = .152	d = .307	Z = .153	SE_z = .224	<-.278; .531>
Visscher & Witziers (2004)	r = .109	d = .219	Z = .109	SE_z = .167	<-.214; .410>
Bolam et al. (2005)	r = .185	d = .376	Z = .187	SE_z = .082	<.027; .334>
Summary effect	r = .121	d = .246	Z = .122	SE_z = .031	< .062; .182>

Table 5. Meta-analysis results

Fixed effect			Random effect		
Coefficient	SE_z	p value	SD	Variance across studies	p value
.121	.029	.020	.002	.001	>.500

The meta-analysis and the summary effect size

The meta-analysis was performed using a random effects model presented in Appendix 1 (Formulas 9 and 10) and implemented in the HLM6 program (Raudenbush & Bryk, 2002). Table 5 shows the raw results of the meta-analysis.

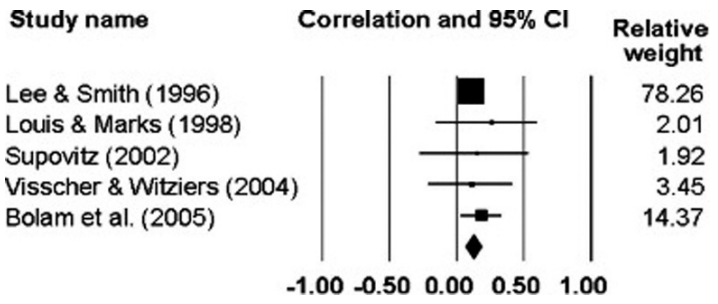
The random effects model indicates a significant coefficient *Z* of .12 ($p < .05$), with a standard error of .03 and a standard deviation of .002 (see Table 5). Using the formulas presented in Appendix 1 (Formulas 6 and 7) (Borenstein et al., 2009) for making the calculations, the meta-analysis result was transformed into a Cohen's *d* effect size of .25. Table 4 presents the summary effect of the meta-analysis, together with the standard error and the 95%confidence interval for the correlation coefficient.

To be able to interpret the findings of the meta-analysis properly, the relative weight of each study was taken into account by performing the analysis using the comprehensive meta-analysis program (Borenstein et al., 2009) and obtaining a representation of the results in a forest plot (see Figure 1).

The forest plot is a specific representation of the effects found in this specific context. The horizontal lines in the forest plot represent the spread of the 95% confidence interval for each of the effects. In addition, these results are represented by a square box within the boundaries of each confidence interval (Borenstein et al., 2009). The size of the square box is directly proportional to the weight of each study in the analysis, the weight being calculated on the basis of the sample size, in this case determined by the number of schools indicated in Table 3.

In order to facilitate a clear understanding of how the weight of the studies was taken into account in the analysis, Figure 1 also includes the determined relative weights. This implies that the study with the highest number of schools is given the largest weight in determining the final result. Finally, the diamond represents the summary effect bounded by its confidence interval.

Figure 1. Forest plot for meta-analysis results



The forest plot shows that the pooled effect is based on five effects that vary between studies. The boundaries of the confidence intervals explicitly indicate that Lee and Smith (1996) and Bolam et al. (2005) have been the most precise in estimating their effects. In addition, the size of the square boxes points out that the followed by Bolam et al. (2005) with 14%. The summary effect indicates a small positive effect of professional community on student achievement of .12 (see Table 4). The size of the diamond specifies the range of the 95% confidence interval, respectively between .06 and .18. In conclusion, the forest plot shows that the effects obtained vary per studies and that the summary effect has a relatively small spread. In addition, the 95% confidence interval of the pooled effect does not cross the zero line, which indicates a significant overall result of .25 effect size (see Table 4).

A check of the sensitivity issues is important for determining the robustness of the findings (Borenstein et al., 2009). Considering the limited number of studies, however, excluding one from the analysis is not recommended, taking into account also the associated low power in performing the statistical tests.

Summary of the results, limitations of the study, and directions for future research

Summary of the results and discussion

In line with the objectives of this paper, we have addressed the different perspectives on the concept of professional community and summarized and interpreted its effects on student achievement in secondary education, as established in our research sample.

Given the many theoretical perspectives and the different terms used, our first aim was to further clarify the professional community concept. Our review shows that many authors

(e.g., Cranston, 2007; Furman-Brown, 1999; Hord, 1997; Plank, 1997; Toole & Louis, 2002) agree that there is no universal definition of the construct. From a temporal perspective, the professional community concept has had a long development process, starting around 1982 with the introduction of *collegiality* and *collaboration*, while it was defined and operationalized as *professional community* after 1995 as part of the comprehensive reform program in the USA, and developed around the year 2000 into *professional learning community*.

The professional community concept has, however, remained ''fuzzy'' (Visscher & Witziers, 2004, p. 786), while its multidimensional nature still needs to be approached more systematically. Moreover, establishing a generally accepted paradigm for the concept appears to be difficult because of its diverse educational settings. Beck (1999) indicated that there are many metaphors of educational community, referring mainly to shared activity and common norms and values, and interactions and conversations with the goal of fostering student learning. As regards its operationalization, Kruse et al. (1995) identified five interconnected variables that could be used to measure the concept, namely *reflective dialogue, deprivatization of practice, cooperative practices, collective responsibility,* and *focus on student learning*. However, there were also studies that used different conceptualizations and operationalizations, as shown by our meta-analysis. Of the five studies, four used the five interconnected variables or a derivation while Supovitz (2002) referred to the interaction-based character of schools. In sum, the operationalization of the professional community concept differs among the various studies, but the ''communitarian character'' paradigm is common.

In conclusion, there are some indications that the different components of the concept of professional community as distinguished theoretically can indeed be measured as separate variables or that these variables can be integrated into one factor, based on the assumption that these components all refer to the underlying constructs of professionalism, learning, and community.

The second aim of this study was to explore the existence and size of the effects of professional community on student achievement in secondary schools. Based on the selection criteria used, we were able to analyze five quantitative empirical studies.

Our calculation of the effect sizes based on the results reported has produced the following results, presented as Cohen's *d* effect sizes: .22 (Lee & Smith, 1996), .31 (Supovitz, 2002), .56 (Louis & Marks, 1998), .22 (Visscher & Witziers, 2004), and .38 (Bolam et al, 2005). This is a relatively broad spectrum of effects, ranging from small to medium impacts. This spread implies that the effects of professional community are diverse but positive. When including these effects in the meta-analysis, the 95% confidence interval of the summary effect did

not cross the zero line, indicating a significant overall result, with a summary effect size of .25. Although relatively small, this result shows that the relationship between professional community and student achievement is positive and significant.

With respect to the small effect size as established in this meta-analysis, when investigating the effect of one school on many students, even the smallest effect may be highly relevant (Witziers, 1992). Additionally, there are many teacher and school characteristics that could influence or condition the effect of professional community on students' achievement, as indicated in the review of Cormier and Olivier (2009) and Little (2006). Issues such as leadership, professional development programs, or trust have been hypothesized to condition the raison d' être and impact of professional community within schools.

Limitations of the study

Considering that this meta-analysis was based on five studies with specific differences in their conceptual and methodological approaches, some specific limitations need to be taken into account in interpreting the results obtained.

A first limitation is the small number of studies included in the analysis, which has reduced the reliability of generalizing the results. The effects found were small but significant. Still, this study answers to an obvious need for assessing the effect of professional communities on student achievement, and the five studies analyzed have formed a promising start. Furthermore, the international perspective adopted in our study has been rather limited, considering that only three countries were included in our research, namely the USA, England, and The Netherlands. Moreover, the studies conducted in the USA and England were the most significant in terms of weight, which indicates that the Anglo-Saxon approach may have been overrepresented in this particular research context. Because of this limitation, the results of the meta-analysis could not be generalized to other countries than to the USA and England.

A second limitation relates to the conceptual and methodological characteristics of the studies. As mentioned before, all five studies differed regarding the concepts and measurements employed, the model specifications used, and the type of outcomes obtained. First, the countries where the studies were conducted all have different views with respect to the size and context of the schools and the type of student assessment measures used. Furthermore, in some studies the different sub-dimensions of professional community were included as separate predictors in the analysis (Lee & Smith, 1996; Visscher &Witziers, 2004), while in other publications a composite or a general index of professional community was used (Louis & Marks, 1998). The same holds for the nature and number of the control and background variables used in the models to estimate the effects of professional community

on student achievement. As regards the outcome variables, some researchers used a general indicator of student achievement (Bolam et al., 2005), while others worked with student gains or progress (Lee & Smith, 1996; Supovitz, 2002). Furthermore, in two studies (Lee & Smith, 1996; Supovitz, 2002) the scores referred to various disciplines, such as mathematics, writing, and science. Because of these differences among the studies, the results should be generalized with caution.

In addition, with respect to the relative weight of the final results as presented by the studies, the pooled effect is significant, but it should be pointed out that this result has been mainly determined by the considerable weight of one study, namely Lee and Smith (1996), which reported a small effect.

Future research directions

Overall, it can be concluded that the results obtained by our study have sufficient relevance both for future research and for educational practice, even when taking the limitations indicated into account. However, there are still a number of difficulties in working with the concept. These issues could be tackled in future research.

The need for a clear conceptualization

As indicated by the evidence from the theoretical frameworks and the conceptualizations as conducted in the five studies, the concept of professional community still needs to be clarified more in detail. The multiple theoretical perspectives and different terms used, as well as the generalized application of the concept, make it hard to grasp and define it. Spillane and Louis (2002) argue that the concept of professional community ‘‘provides a basis for synthesizing the conceptions of a variety of writers on education’’ (p. 93). Following this line of reasoning, we suggest that a universal definition of the professional community construct needs to be formulated. However, this definition has to delimitate the concept sufficiently by integrating its underlying latent constructs of community, learning, and professionalism and by differentiating it from other related concepts.

The need for empirical validation of the concept’s key sub-dimensions

The difficulty of defining the concept also manifests itself in its operationalization and the delimitation of its key sub-dimensions. As already observed, the various authors differ in their specifications of the concept, tested more or less thoroughly in the empirical designs. The main conceptual and methodological requirement at this point is an empirical validation of the characteristics of the professional community construct and a general agreement on its components.

During the past 2 decades, the five interconnected variables, namely *reflective dialogue, deprivatization of practice or feedback on instruction, collaborative activity, shared sense of purpose,* and *a collective focus on student learning* have gained considerable momentum in the fields of theoretical and empirical research. Also on an individual basis, most of these variables have proven to be important for school effectiveness. Specifically the *collective focus on student learning* and *collaborative activity*, which form part of the model of educational effectiveness (Creemers, 1994; Creemers & Kyriakides, 2008; Purkey & Smith, 1983; Scheerens, 1990, 1992; Scheerens & Bosker, 1997; Stringfield & Slavin, 1992), have received a great deal of attention in the area of empirical research. Sammons, Hillman, and Mortimore (1995) have also added *shared sense of purpose* to the conditions that enhance school effectiveness. The variables mentioned above have been used in some meta-analyses, and they have proven to be important school determinants of student success and school effectiveness (Creemers, 1994; Glenn, 1981; Hattie, 1992; Odden, 1982; Scheerens & Bosker, 1997). Examples of effect sizes obtained in the meta-analyses are .06 for *cooperation* and .27 for *pressure to achieve* (Scheerens & Bosker, 1997 in Marzano, 2000). In conclusion, in the research area of school effectiveness it has been generally recognized that most of the five interconnected variables individually produce significant school-level effects, which is why they have become important predictors of student success.

What is still unclear, however, is the argument for integrating these variables into one concept, that of professional community. The methodological decision of grouping several essential characteristics into one factor still needs more empirical support. What is required is a proper validation of the professional community measurement by explicitly relating the concept to its underlying latent constructs. Still, authors like Beck (1999) pointed out the need for ''caution about defining community as *a* variable or *a* construct characterized by a narrow or limited set of variables'' (p. 36), because it might be ''taking a rich, complicated, and invariable dynamic phenomenon and reducing it in a way that runs counter to our common conceptual systems'' (p. 37). This draws the attention towards a coherent validation process that takes into account the complexity of the concept of professional community.

The need for more empirical studies

Professional community has appeared essential for establishing school change (Little & McLaughlin, 1993; Rosenholtz, 1991; Spillane & Louis, 2002), and our meta-analysis has proven its importance for student achievement. Considering the value of the concept and its vast theoretical coverage, there is a clear need for more empirical studies. Specifically, more multilevel studies are required in order to address the teacher and school-level characteristics (Bosker & Scheerens, 1994; Sleegers et al., 2002) and to specify more clearly which facilitate the professional community activities. In addition, there is a call for more longitudinal studies aimed at investigating the effect of the concept over longer periods and

designing a cognitive achievement measure that offers insight into student progress rather than producing one single test result (Hofman & Dijkstra, 2010). In addition, aside from the issues of change and innovation, we consider it desirable to conduct more research into the functioning of professional community in the day-to-day practices within schools. It would be interesting to see whether teachers have actually integrated the professional community approach into their daily practices on their own initiative rather than in response to external measures of change or governmental pressure.

The indirect causal mechanism

As mentioned in the discussion of the results, the relatively small but clear effect of professional community may also be explained by the occurrence of possible mediators or facilitators within the educational effects model. There are many quantitative studies, which have investigated the relationship of professional community with other school or teacher characteristics (Alberta Education, 2006). The results of these studies suggest that professional community is also related to a large number of other predictors of student achievement, which according to a multilevel or pathway perspective could be considered as producing indirect effects. With respect to professional community, a similar comprehensive model of mediated or reciprocal effects was proposed and investigated by D'Amico et al. (2001), Newmann, King, and Youngs (2000), Talbert, (1991), and others.

As a final remark, the relationship between professional community and student achievement might not claim a strong direct causality, but it does imply that if professional community would be present in secondary schools, it would enhance student achievement. Finally, the development process of professional community has been long and diverse, forming an important component of school culture (Maslowski, 2001; Staessens, 1993). Of late, a great deal of attention has been paid to the promotion of its development and the improvement of its efficacy (Hipp & Huffman, 2003). However, another topic of interest is the balance between teacher collaboration and teacher autonomy in relation to expertise. There are examples of studies, such as Clement (1995) and A. Hargreaves (1994), which show that tension between collegiality and autonomy could hinder the collaboration. Further, the difference between effective and ineffective professional communities has not yet been investigated in full detail. In brief, there are still many aspects of professional community that need exploration. Although our meta-analysis has confirmed a significant and positive effect of professional community on student achievement in secondary schools, given the limitations of this study, the research into the conceptualization and effectiveness of this concept should be continued.

Appendix 1. Statistical issues and calculations

The variance explained at school level transformed into total variance explained between students

$$R^2 \text{ between students} = R^2 \text{ school level} * [\tau^2 / (\tau^2 + \sigma^2)] \quad (1)$$

where

R^2	total variance explained
$\tau 2$	variance between schools
$\sigma 2$	variance within schools

The total variance explained between students transformed into correlation coefficient

$$R^2 = r_{xy}^{\ 2} \qquad r_{xy} = \sqrt{R^2} \quad (2)$$

where

R^2	total variance explained between students
r_{xy}	correlation coefficient

The transformation from sample correlation r to Fisher's Z

$$Z = 0.5 * \ln [(1 + r) / (1 - r)] \quad (3)$$

where

z	Fisher's Z
r	correlation coefficient

The variance of z is

$$V_z = 1 / (n - 3) \quad (4)$$

where

n	number of schools

The standard error of z is

$$SE_z = \sqrt{V_z} \quad (5)$$

where

V_z	Variance of Z

To convert the Fisher's z value back into a correlation

$$r = (e^{2z} - 1) / (e^{2z} + 1) \quad (6)$$

where

z	Fisher's Z
r	correlation coefficient

The correlation transformed into Cohen's d

$$d = 2r_{xy} / \sqrt{(1 - r_{xy}^2)} \quad (7)$$

where

r	correlation coefficient

To calculate the 95% confidence intervals

$$Conf = \beta +/- 1.96 * SE \quad (8)$$

where

β	the regression coefficient
SE	standard error

The model used to calculate the summary effect size is:
(Raudenbush & Bryk, 2002, p. 209-210)

$$d_j = \delta_j + ej \quad (9)$$

$$\delta_j = \gamma_0 + uj \quad (10)$$

where

d_j	observed effect size in study j
δ_j	true effect size in study j
e_j	random sampling error
γ_0	true effect size in the population
u_j	residual for study j

Endnotes

We started our analysis with the study of Lee and Smith (1996). As presented in Table 3, for each study we specifically focused on the effects, standard errors, p values, and the number of schools. Lee and Smith (1996) used multilevel modeling to take the nested structure of the data into account. In addition, their study reported on the relationship of professional community implemented for a number of subjects, namely mathematics, reading, history, and science. Moreover, considering that *teacher control* is not a common indicator of professional community, we included in the analysis only the coefficients for *responsibility for learning* (.33, $p < .001$) and *cooperation* (.15, nD). Bearing in mind that the characteristics of professional community were introduced as separate items in the analysis, only the effects for one subject, specifically mathematics, could be covered for the two items. Specific effect sizes were obtained, as presented in Table 3, with a mean effect size value of .24. Given that, the authors reported the results in effect sizes, specific computations were applied using the standard deviation at school level, and a value of student-level correlation of .11 was obtained.

Louis and Marks (1998) conducted a multilevel modeling approach. Their research sample consisted of 24 schools, and they found a positive and significant effect of professional community on student achievement ($\beta = .26$, $p < .001$), while controlling for elementary level and student background variables. Taking into account these relevant characteristics, the student-level correlation coefficient of .26 was kept.

Supovitz (2002) operationalized the professional community concept as *group instructional practices* and applied multilevel modeling to investigate its relationship with student achievement in 79 schools. He found a small and significant effect on student achievement. Supovitz (2002) investigated the results of five subjects: writing, reading, mathematics, science, and citizenship in five grades: Grade 4 to Grade 8. Considering that the age range of the students in these grades was similar to those in the other four studies, the scores for Grade 6 (a middle grade) were used for our analysis (see Table 3). Next, the mean variable (Borenstein et al., 2009) of the five outcomes for Grade 6 was calculated on the basis of 23 teams applying *group instructional practices*, with a student-level correlation coefficient mean value of .15 ($r = .15$).

Visscher and Witziers (2004) investigated the effect of professional mathematics community on achievement of students in mathematics in 39 schools, using multilevel data analysis. They found a significant effect. In this case, the authors reported that 6% of the 20% school-level variance ($p < .10$) was explained by the professional community variables. In sum, professional community accounted for 1.2% of the total explained variance among students (see Appendix 1, Formula 1). After performing other calculations required (see Appendix

1, Formula 2), the student level correlation coefficient obtained between professional community and studentachievement was .11.

Finally, Bolam and colleagues (2005) performed a correlation analysis at school level to investigate the relationship of professional community with student achievement in 153 secondary schools, correcting the student achievement measures by relevant student and school covariates. We call this measure of student achievement overachievement. The authors found a school-level correlation of .16 ($p < .01$) for the *professional and student learning ethos factor* and a correlation of .18 ($p < .01$) for the *within school policy, management and support for professional learning* factor, both representing the professional community concept with a correlation mean value of .17. Using specific computations (see Appendix 1, Formulas 1 and 2) and assuming that the sign and the direction of the relationship is the same at student level, a student-level correlation coefficient of .18 was obtained.

CHAPTER 3.

The relationship between departments as professional communities and student achievement in secondary schools.

The relationship between departments as professional communities and student achievement in secondary schools[1]

Abstract

Secondary school teaching is organized in departments and effective departments functioning as collaborative teams have been associated with effective schools. Therefore, this study investigates the relationship of mathematics departments perceived as professional communities and student achievement in Dutch secondary schools. Cluster analysis and hierarchical linear modeling (HLM) were used on a sample of around 3000 students, 130 schools, and 130 teachers that participated in this study (TIMSS-2003 data). The significant effects found (effect size >.20) show that those departments that focus on reflective dialogue, collaborative activity, shared vision and student achievement are associated with successful schools and higher student achievement.

Keywords: Secondary schools; subject departments; teacher professional community; student achievement; successful schools

1 Based on Lomos, C., Hofman, R. H., & Bosker, R. J. (2011). The relationship between departments as professional communities and student achievement in secondary schools. *Teaching and Teacher Education, 27*(4), 722-731.

Introduction

Teachers in secondary schools tend to organize their work in separate departments, based on the subject they teach, such as mathematics, science, or language (Grossman & Stodolsky, 1994). These departments represent the various groups of professional staff members responsible for coordinating the subject curriculum (Visscher & Witziers, 2004), forming "the most common unit for organizing secondary school teaching" (Busher & Harris, 1999, p. 312). Based on an inventory of Worner and Brown (1993), these departments' interests are focused on several elements of the teaching job, such as educational goals, the subject matter, teaching methods and strategies, didactical materials, innovation, evaluation, testing, and training new teachers (Burn, Childs, & McNicholl, 2007; Kuhlemeier & Bergh, 2000). According to Little (1995), the subject department units represent the teachers' direct professional environment, serving as the main point of reference for their teaching beliefs, knowledge, practice, and professional commitment (Burn et al., 2007; Stodolsky & Grossman, 1995; Talbert & McLaughlin, 2002). In addition, the departments are also the principal unit where collaborative planning and the implementation of policies take place (Grossman & Stodolsky, 1994; Huberman, 1993; Little, 1993).

Taking in account the important roles of departments for teachers and students, Harris (2001) advocates the need for sustaining their effectiveness and improving their efficiency. Previous studies (e.g., Busher & Harris, 1999; Harris, Jamieson, & Russ, 1995) indicated that effective departments function as collaborative teams and professional communities, fostering collegiality and shared vision (Kruse & Louis, 1997; Little, 1993). Moreover, departments characterized as professional communities have been hypothesized to have a positive effect on student achievement (Visscher & Witziers, 2004). To sum up, it seems of importance to investigate to what extent departments within secondary schools function as professional communities and to what degree this is related to student achievement

Literature review

Professional community as a framework for the departmental unit

As indicated before, a relevant question in this respect is what makes departments professional communities. Kruse, Louis, and Bryk (1995) "designated five interconnected variables that describe what they called genuine professional communities in such a broad manner that they can be applied to diverse settings" (Toole & Louis, 2002, p. 249). The five interconnected characteristics of professional community have become a common operationalization of the concept and it has been used in many empirical studies (e.g., Bolam et al., 2005; Bryk, Camburn, & Louis, 1999; Louis & Marks, 1998; McLaughlin &

Talbert, 2001; Newmann & Wehlage, 1995; Supovitz, 2002;Wahlstrom & Louis, 2008).
The five interconnected variables of a professional community are namely *reflective dialogue, collaborative activity, the deprivatization of practice, a shared sense of purpose or collective responsibility,* and *focus on student learning*. We will give a definition of each of these sub-concepts, based on Louis and Marks (1998).
Reflective dialogue refers to the extent to which teachers discuss specific educational issues with one another on a professional basis. *Deprivatization of practice* means that teachers monitor one another's classes for feedback purposes. *Collaborative activity* is a temporal measure of the extent to which teachers engage in cooperative practices. *Shared sense of purpose* refers to the degree to which the teachers agree with the school's mission and its operational principles. And finally, *collective focus on student learning* indicates the mutual commitment of teachers to student success.

To be more specific, *reflective dialogue* implies mentally focused discussion and reflection on instructional practice, while *collaborative activity* implies teachers working in a hands-on way in real time practice with a concrete outcome, such as instructional programs or materials. In addition, reflective dialogue tends to focus on analyzing past instructional practice and results of instruction, such as student achievement, in order to consider making changes for future practice. At a closer look at the general definition, the five characteristics presented could be classified into two major categories, namely *interaction between teachers* represented by reflective dialogue, collaborative activity, and deprivatization of practice, and *shared vision* represented by shared vision and shared focus on student achievement.

School or department professional community and student achievement

Quantitative as well as qualitative investigations into the concept of professional community, its characteristics within the school, and its effects on student achievement, became more common in the late 1980s and 1990s, especially in the United States. Pioneers in this field were Darling-Hammond (1984), Little (1982), and Rosenholtz (1989). These researchers particularly studied the organization of effective schools and regarded the development of professional work groups and mutual support as major facilitators of commitment and effort with the potential for improving student learning (Louis & Marks, 1998). Regarding the effects of professional community, Lomos, Hofman, & Bosker (2011a) conducted a meta-analysis, establishing that the current empirical research shows a positive relationship between this concept and student achievement in secondary schools.

However, a distinct discussion within the professional community literature on secondary schools is whether professional community is being observed at the school or at the department level. Moreover, it is important to mention that some of the literature on the departmental organization of secondary schools has expressed the concern that the

departmental structure might actually fragment teachers' work and the curriculum, thereby undermining forms of collaboration and communication among the teachers in the entire school (Lee & Smith, 1996; Visscher & Witziers, 2004).

The same distinction between the school and department-based professional communities has been visible in previous empirical studies performed and in the choice of their investigation method. Most of the studies using quantitative research methods investigated professional community as a school trait and focused on its relationship with student achievement. Such studies (e.g., Bryk et al., 1999; Louis & Kruse, 1995; Newmann & Wehlage, 1995) were performed mostly in the 1995s in the United States, as part of the comprehensive school reform movement, when professional community was adopted as a predictor of student success. Even if these studies defined professional community as a school trait, specific attention was paid to the subject matter for which the community was encountered. To illustrate, Newmann, Marks, and Gamoran (1996) focused on teachers of mathematics and social studies; Lee and Smith (1996) concentrated on mathematics, reading, history and science achievement gains and designed a new measurement to capture the differences between the departments; and Louis and Marks (1998) controlled for subject matter when investigating the effect of school professional community in their study.

Interestingly, most of the studies using qualitative methods of research have focused on professional community as a department trait, specifically mathematics and English language (e.g., Berry, Johnson, & Montgomery, 2005; Dalgarno & Colgan, 2007; Evans-Stout, 1998; Grossman & Stodolsky, 1994, 1995; Siskin, 1991, 1994; Spillane, 2005; Talbert, 1991). This empirical evidence has indicated that belonging to a subject department is still important in several ways, namely the well-being of the teachers (Siskin, 1991), their opportunity for professional development (Grossman & Stodolsky, 1994), the school's ability to change and innovate (Kruse & Louis, 1997; Siskin, 1997), pupils' learning capabilities (Harris et al., 1995), and consequently, the school's success (Luyten, 1994; Turner, 1996). In addition, the Dutch studies on the organization and performance of departments indicated that departments are a good environment that could facilitate collaboration, shared vision and, collective decision-making (Witziers, 1992).

To summarize, departments remain important organizational units in secondary schools, as long as they function effectively. In addition, most teachers attribute their success primarily to departmental assets rather than to facilities provided at the school level (Harris et al., 1995).

Research problem

Kuhlemeier and Bergh (2000) posed the following relevant question: "Which characteristics of departments are responsible for the supposed positive contribution to student achievement?" (p. 352). In addition, Melville and Wallace (2007) inquired how departments operate as learning communities, while Visscher and Witziers (2004) investigated the effect of departments that function as professional communities on student achievement. And as established before, the extent to which departments function as professional communities seems to be an indicator of both their effectiveness and of student success.

Regarding the American secondary schools, authors such as Little (1993, 1995), Siskin (1991, 1994) and Talbert and McLaughlin (2002) confirmed that teachers have a strong subject-related identity and their teacher collaboration is mainly focused on department-related schoolwork. About the secondary schools in the Netherlands, most of the studies on subject departments conducted in the 1990s (e.g., Hylkema, 1990; Kuhlemeier & Bergh, 2000; van Wessum, 1997; Witziers, 1992), indicate that during that time, teachers' work was also department-related, but most departments could hardly be considered as professional communities (Witziers, 1992). Considering the facts about the importance of collaboration among teachers within the departments, it would be interesting to investigate whether during the past decade, the departments have actually developed into professional communities.
In this context, our study was performed in Dutch secondary schools, with a specific focus on mathematics departments. Our *first* research question inquires whether the departments in Dutch secondary schools have indeed become professional communities, and to what extent. Our *second* research question relates to the hypothesis that strong professional community departments are associated with strong and successful schools, and that schools could be classified into categories based on the strength of the professional community manifestations of their departments. Finally, our *third* research question investigates whether the fact that departments within schools function as professional communities affects student achievement.

For this study, a number of 130 mathematics teachers from 130 Dutch secondary schools were selected. This choice was based on previous findings, which indicate that mathematics departments are good examples of professionalization in secondary schools (Stodolsky & Grossman, 1995). Moreover, mathematics and science teachers consider consultation with their subject-related colleagues as very important. They are, in fact, the most outspoken with respect to this issue, compared to colleagues from other departments (van Veen, Sleegers, Bergen, & Klaassen, 2001). In addition, the professional identity of math and science teachers is strongly associated with their subject-related topics (Melville & Wallace, 2007), which is manifested by a strong sense of subject community. Specifically related to Dutch secondary schools, a quantitative study by Visscher and Witziers (2004) questioned

whether the label of mathematics departments as professional communities is actually justified, considering the altogether disappointing frequency of their specific joint activities. To conclude, the findings of the abovementioned studies have been instrumental in our choice to investigate to what degree the mathematics departments actually function as professional communities, and whether their functioning is related to student performance. In this context, our study will investigate the relationship between mathematics departments that actually work as professional communities in accordance with the five characteristics as introduced above, and improved student achievement. Our search for significant outcomes has been encouraged by the results of a number of effectiveness research models, which indicate that shared vision and goals, a learning environment, high expectations, a focus on teaching and learning, and a learning organization (Marzano, 2003) prove to be important predictors of student success.

Design of the study

In the past twenty years, there has been an increasing interest in the field of educational effectiveness, represented by the elaboration of many models of effective schools. Relevant examples are the approaches of Bosker and Scheerens (Bosker, 1992; Bosker & Scheerens, 1994; Scheerens, 1997), and those of Sammons, Hillman, and Mortimore (1995), which have indicated one important fact, namely that student performance is determined by various factors at different levels of the school environment. Therefore, in order to obtain a reliable assessment of the effects of a professional community, it is necessary to also include and control for other important predictors of student success. These predictors occur at different levels, namely the student, teacher, and school level.

This is why our research model, based on previous models adapted to TIMSS data (Vos & Bos, 2005), has specifically controlled for particular multilevel predictors.

Sample

This research is based on data obtained from the Third International Mathematics and Science Study (TIMSS), conducted in 2003 at the eighth-grade level (TIMSS-03) in the Netherlands. The population of TIMSS consists of: “all students enrolled in the upper of the two adjacent grades that contain the largest proportion of 13-year-olds at the time of testing” (Foy & Joncas, 1999, p. 30). The basic sample design for TIMSS-03 is generally referred to as a two-stage stratified cluster sample design (Foy & Joncas, 1999).

In the Netherlands, the initial sample size included 2919 students, 130 secondary schools, and 130 mathematic teachers, all from the eighth grade, representing an 87% response

rate (Meelissen & Doornekamp, 2004). After excluding the complete number of missing cases (6 in the school dataset and 8 in the teacher dataset), and retaining the data for one teacher per school, the final sample size to work with was 2706 students, 117 schools and 117 teachers and departments.

It is important to mention that the Dutch secondary education is organized in levels, based on the difficulty and the qualifications obtained. The following main types of secondary education can be distinguished, starting with the lowest level:

1. VMBO: pre-vocational education, 4 years
2. HAVO: senior general education, 5 years
3. VWO: pre-university education, 6 years

Pre-vocational secondary education (VMBO) includes pupils between the ages of 12 and 16 and provides general and prevocational education for further vocational training. Senior general secondary education (HAVO) is for pupils aged 12-17 years and it provides general education as a base for further higher professional education. Pre-university secondary education (VWO) is for pupils aged 12-18 years, and it prepares them for university studies. The TIMSS-2003 used a stratified sampling procedure and selected 45% VMBO, 18% HAVO/VWO, and 37% VMBO/HAVO/VWO schools (Meelissen & Doornekamp, 2004). Moreover, in the TIMSS-2003 dataset, the last two types of schools have been put together into one category. This means that in our analysis, we can only compare two types of schools: The VMBO schools versus all other types of schools or, put differently, the *pre-vocational schools* (45%) versus the majority of *more academically focused schools* (55%).

Variables

This section deals with the variables to be taken into account in order to obtain reliable results, together with the main professional community items and the dependent variable. Regarding the control variables, at the *student level*, they indicate whether the student was a girl or a boy, whether he/she and his/her parents were born in the country, the number of books at home, and home resources such as a desk, a calculator, and a computer. At the *teacher level*, the control variables show whether the teacher was a female or a male, his/her age, the type of formal education finished, the number of years of his/her initial training, and the number of years that he/she has worked as a teacher. Finally, at the *school level*, the control variables tell us whether the school was situated in a small or large community, school size, whether it was a pre-vocational school (VMBO) or part of the majority of more academically focused schools, and whether it accommodated a high percentage of students with an economic less advantageous background or a high percentage of students with Dutch as their first language.

An item in the TIMSS-questionnaire, as presented in Table 1, measured each of the five characteristics of the professional community concept.

Table 1. Professional community items in the TIMSS teacher questionnaire

Items	TIMSS questions	Type of characteristic	Measurement
How often are you involved in the following types of interaction with other teachers?		Interaction	Never or almost never 1-3 times per week 2 or 3 times per month Daily or almost daily
Reflective dialogue	Discuss how to teach a particular concept		
Collaborative activity	Working on preparing instructional materials		
Deprivatization of practice	Visiting another teachers' classroom to observe his/her teaching		
How would you characterize each of the following items?		Shared vision	Very low Low Medium High Very high
Shared sense of purpose	Teachers' understanding of the schools' curricular goals		
Focus on student learning	Teachers' expectations of student achievement		

The professional community characteristics are based on the perceptions of the 117 teachers regarding the mathematics departments they belong.

In order to investigate the representativeness of the TIMSS items for measuring the professional community indicator, a comparison was made with similar items belonging to professional community models and measurements developed by other leading researchers, which are presented in Table 2, Appendix 1.

Since the mathematics professional communities were the primary focus of our research, the dependent variable chosen was mathematics achievement. The development of the TIMSS math achievement tests and items has required intensive international consultation in order to provide frameworks capable of measuring what is regarded as important in all the countries involved. The mathematics-related items in TIMSS-03 focused on number, algebra, measurement, geometry, and mathematical data (Martin, 2005). In order to assure the reliability and representativeness of the achievement tests, TIMSS-2003 developed a set of frameworks based on the input from an international panel of experts in mathematics and testing. Moreover, a questionnaire was sent to participating countries about topics covered in their curriculum. Considering that the test items focused not only on content and skills, but also on students' analytical, problem solving, and inquiry capabilities, the test items are relevant for all types of secondary education.

In addition, considering that in large-scale assessments, student performance is measured with only one subset of the total item pool (von Davier, Gonzalez, & Mislevy, 2009), plausible values[2] were used as the multiple values of the likely distribution of students' proficiency in order to obtain unbiased group-level estimates. In our analysis, we included five plausible values representing student achievement. In addition, it is important to note the fact that this study used student achievement data measured at one point in time as opposed to a measurement of change in achievement over time. Such a measurement of change would provide a more accurate indicator of students' achievement growth, and a more long-term assessment of the impact of professional community on student achievement. However, considering that the aim of this study is to investigate the association between the department professional community and student achievement, the data offered by a one-time measurement point is satisfactory as a starting point.

2 "Plausible values are based on student responses to the subset of items they receive, as well as on other relevant and available background information" (von Davier et al., 2009, p. 11). "Plausible values can be viewed as a set of special quantities generated using a technique called multiple imputations" (Von Davier et al., 2009, p. 11).

Data collection and analysis

Instruments

The TIMSS data-collection instruments (achievement tests and student, teacher, and school background questionnaires) were prepared in English and translated into 33 languages. For the TIMSS 2003 main mathematics survey, each country was provided with the following instruments, which they could adapt, if necessary: Eight booklets of mathematics achievement items, one Student Questionnaire, one Mathematics Teacher Questionnaire, and one School Questionnaire (O'Connor & Malak, 1999).

Analysis methods

Due to the three-level character of the data, with students nested within teachers/classrooms and teachers/classrooms nested within schools (Snijders & Bosker, 1999), we used hierarchical linear modeling (HLM) to investigate the relationship between mathematics professional communities and student achievement. However, in the TIMSS dataset, the teacher/classroom level coincided with the school level, because our analysis included only one teacher per school. Therefore, the nesting structure of the data was: students within schools, which could explain the variance in the mathematics achievement scores among students and among schools. Actually, the teacher indicated his/hers perceptions of the professional community characteristics of their department, and consequently their school. The HLM statistical package was used to consider the five plausible values simultaneously in our analysis. In addition, all the numerical variables used in the model were transformed into z scores and centered around the mean. Further, for a clear presentation of the explained variance, the effect sizes and the confidence intervals were calculated. The effect sizes were calculated as twice the square root of the explained variance on school level.

In addition to determining the main effects of professional community on student achievement, we assumed that by answering our second research question, the synergetic effects of joined professional community variables would enable us to better explain the variation between schools. We hypothesized that the classifications of the schools would differ depending on their use of the five specific actions of professional community. A hierarchical clustering was employed to establish these classifications.

Although it would have strengthen this study to use a qualitative technique to triangulate the quantitative data, the origins of the professional community concept have been founded on studies using qualitative methods of research, such as case study observations and interviews. Considering that many authors, such as Lee and Smith (1996) pointed out that the theory linking professional community to student learning rests mainly on case study

observations, our study comes to test this hypothesis using a quantitative research design.

Statistical issues

The percentage of missing cases was small, with 5% as the largest for ethnicity (parents born in the country). With respect to the professional community items, the largest percentage of missing cases was 3 for *reflective dialogue*. The missing cases in terms of explanatory and control variables were replaced by the school mean, and a missing dummy variable was created to indicate whether a substitution had been added (=1) or the original score was used (=0). In order to check in the final model whether imputing the school averages in the case of missing values had changed the effect of each variable, these dummies were included for the missing data as predictors in the analysis. Considering that most of the significant variables in the final model were missing in only a small number of cases, none of the dummy variables introduced in the model caused a significant decrease in deviance. In conclusion, no changes were found in the effects caused by the replacement of the missing values by the school mean rather than by a listwise deletion.

Finally, after checking the assumptions regarding the use of the hierarchical linear model, as well as the normal distribution for both levels' residuals, the graphs indicated that all conditions had been met.

Results

The mathematics departments as professional communities

The first research question concerned the characteristics of the mathematics departments in Dutch secondary schools.

The first step in answering this question included a description of the mathematics departments in Dutch secondary schools in terms of the five characteristics, as presented in Table 3.

As regards *interaction between teachers*, *reflective dialogue* is the predominant type of interaction among the math teachers within Dutch secondary schools; 54% explicitly indicated that they discussed two to three times per month how to teach different topics. With respect to *collaborative activity*, 49% of the teachers indicated that they prepared materials together at a frequency of 2-3 times a month. In contrast, however, 42% never or only very rarely collaborated in performing this task. *Deprivatization of practice* had the lowest score, with only 10% of the teachers visiting other teachers' classrooms 2 or 3 times a month, while 87% of them practically never did so. As regards *shared vision*, around 55% of the teachers indicated that a shared sense of purpose and a focus on student learning played a moderate role in their department, whereas according to about 30% of them, these items received a fairly large amount of attention.

Table 3. Characteristics of mathematics community

	Never or almost never	2 or 3 times per month	1-3 times per week	Daily or almost daily	Total
Reflective dialogue	21%	54%	18%	7%	100%
Collaborative activity	42%	49%	8%	1%	100%
Deprivatization of practice	87%	10%	3%	0%	100%
	Very low	Low	Medium	High and Very high	Total
Shared sense of purpose	0%	13%	57%	30%	100%
Focus on student learning	2%	15%	53%	30%	100%

Professional community schools

Our second research question focused on the hypothesis that schools can be classified into groups based on the extent to which their departments function in accordance with the five characteristics of professional community.

In order to answer this question, all five characteristics of professional community were subjected to a cluster analysis to investigate possible differences among the schools and to determine whether different categories of schools could be distinguished on the basis of these differences. Based on the significance of the five factors, four clusters were obtained. Table 4 presents a detailed description of these clusters, including the standardized mean scores, the standard deviations, and the significant mean differences based on the results of the cluster contrast tests.

Table 4. Standardized mean scores, standard deviations, and significant mean differences among the clusters found

Professional Community	Cluster 1 (n=40) 34%	Cluster 2 (n=13) 11%	Cluster 3 (n=33) 28%	Cluster 4 (n=31) 27%
Reflective dialogue	.34 (.87) *	-.25 (1.02)	- .06 (.98)	-.41 (1.01)
	+[a]	-	-	-
Collaborative activity	.08 (.98)	.37 (.88)	.84 (.00)	-1.17(.00)**
	+	+	+ +	- -
Deprivatization of practice	-.35 (.00)	2.81 (.00)**	-.35 (.00)	-.35 (.00)
	-	+ +	-	-
Shared sense of purpose	.73 (.96)**	-.31 (1.03)	-.38 (.78)	-.40 (.69)
	+ +	-	-	-
Focus on student learning	.93 (.66)**	-.42 (.83)	-.55 (.65)	-.43 (87)
	+ +	-	- -	-
Names Clusters	Professional Community (PC)	Deprivatization of Practice (DEP)	Collaborative Activity (CA)	Non Professional Community (Non-PC)

Note.

a. The standardized mean scores between .00 and .50 were assigned a (+); those higher than .50 a (+ +); those between .00 and -.50 a (-); and those lower than -.50 a (- -); **p < .05; **p < .01.*

The first cluster of schools is named *Professional Community* schools, referring to 34% of the schools (40 schools out of 117). This *Professional Community* schools type has scored high on most of the characteristics compared to the other related clusters. These schools show very high scores on the shared sense of purpose item (.73[.96]) and are strongly focused on student learning (.93[.66]). In addition, there is much reflective dialogue and moderate collaborative activity within these schools, which implies that the teachers also frequently meet and discuss how to best teach different mathematical concepts. The deprivatization of practice item is the only characteristic with a marginal score, which implies that the teachers do not frequently visit their colleagues to observe their teaching practices. We typified the Professional community (PC) schools cluster as high school-based professional community schools, with a minor focus on the deprivatization of practice item.

The second cluster of schools, named *Deprivatization of Practice schools*, is only represented by 11% of the research sample (13 schools). The schools in this cluster reported very high scores on the deprivatization of practice characteristic (2.81[.00]) and medium scores on the collaborative activity characteristic (.37 [.88]). It is interesting to point out that these 13 schools are the only ones to have significantly high scores on the deprivatization of practice item. It appears that the math teachers in these schools often meet to work together in preparing teaching materials and observe one another's teaching practices at a highly frequent rate. This is why these schools have been typified as Deprivatization of Practice (DEP) schools cluster, with a focus on collaborative activity.

The third cluster, named *Collaborative Activity schools*, is represented by 28% of the schools in the sample (33 schools). The math teachers in these schools are engaged in only one type of interaction, namely the mutual preparation of teaching materials (.84 [.00]). These schools do not possess any of the other four professional community characteristics. We have typified them as *Collaborative Activity* (CA) schools cluster, with no focus on other professional community activities.

The fourth cluster is represented by 27% of our sample (31 schools). In these schools, none or the least of the aforementioned characteristics were reported. This is why we have labeled these schools as *Non-Professional Community (Non-PC) schools* cluster.

An interesting finding so far, is that 73% of the teachers in our sample were engaged in at least one type of interaction between teachers or shared vision. In addition, 34% of the schools reported a high frequency of professional community activities and 39% of the schools a moderate presence. The next step was to investigate whether these *Professional Community (PC)* schools indeed established higher student performance levels than the other school clusters and could be considered as professionally effective institutions. Table 5 presents the results.

In Table 5, the means of the student achievement scores indicate that the schools' mathematics departments with the higher levels of professional community manifestations are also the schools with the higher student achievement scores in math. This result confirms our hypothesis that the more professional community schools are also the more successful and stronger schools. Furthermore, those labeled as *Non-Professional Community schools* are associated with low student achievement levels, as all the other types of school clusters. Another interesting observation is that the *Deprivatization of Practice* schools (11%) shows the lowest levels of student achievement. This is why we decided to use this cluster as the baseline for our next analysis.

Table 5. Means and standard deviations of student achievement scores in the different professional community school clusters

Clusters	Number of schools	School means
1 Professional Community schools	40	.33 (.79)
2 Deprivatization of Practice schools	13	-.64 (1.20)
3 Collaborative Activity schools	33	-.27 (.67)
4 Non-Professional Community schools	31	-.14 (.84)

Categories of professional community schools and student achievement

The results indicate that the four clusters of professional community schools differ in terms of their student achievement levels. However, in order to make a reliable comparison of the four clusters, we had to take both the pupil population and other characteristics of students, teachers, and schools into account. Multilevel analysis was an appropriate method in this context. Table 6 presents the results after controlling for these factors.

The empty model (Model 1) shows that most of the variance occurred at the school/classroom level, namely 76%. Model 2 introduces the student level explanatory variables, such as the individual characteristics and aspects of their socio-economic status. Of the five student control variables, three were significant ($p < .01$), namely gender, ethnicity, and nationality, all with a positive effect on students' achievement in mathematics. The most important findings were that boys performed better than girls, that students with both parents born in the Netherlands performed better than students whose parents were not born in the Netherlands, and that students born in the Netherlands performed better than students not born in the Netherlands.

The explanatory variables on the teacher/classroom and school level are introduced in Model 3. There were ten relevant variables. Of these ten variables, three had a significant effect ($p < .05$) on student achievement, namely secondary school type, the students' economic background, and the schools' nationality background. The results indicate that students attending the majority of more academically focused schools achieved better in mathematics than students attending pre-vocational schools (VMBO). In addition, schools with a high percentage of students with an economically disadvantaged background showed lower achievement levels in mathematics than schools with a low percentage of economically disadvantaged students. Finally, schools with a high percentage of students born in the Netherlands showed better math performance levels than schools with a low

percentage of students born in the Netherlands. It is interesting to mention that students' achievement was not significantly influenced by the school size.

Model 4 shows the effects of the five characteristics of professional community on student performance. These five characteristics explain an additional 7% of the variance among schools, with an effect size of .24, a small effect in Cohen's (1989) terms. Further, only the *Focus on student achievement* item had a positive and significant relationship with student achievement.

Model 5 introduces the classification of professional community schools into clusters. We were especially focused on the effect of *Professional Community* schools in comparison with the *Collaborative activity* and *Non-Professional Community* schools. The three clusters were contrasted with the *Deprivatization of Practice* schools cluster (the baseline), of which the average score on student achievement was the lowest. Of these three clusters, only *Professional Community* schools proved to have a significant relationship with student achievement, explaining an additional 5% of the total variance, with an effect size of .20, which is a small effect (Cohen, 1989). The last two clusters, the *Collaborative Activity* schools and the *Non-Professional Community* schools seemed to have no significant relationship with student achievement. In order to verify whether this was indeed the case, contrast tests were performed in HLM and in all three cases, no significant contrast effects were found.

Considering that school type (the majority of more academically focused schools against VMBO) explained a significant part of the variance[3], an interesting question was whether *Professional Community* schools were either VMBO or the majority of more academically focused schools, or both. In other words, we were interested in whether the effect of *Professional Community* math departments of the majority of more academically focused schools differed from the effect of professional community math departments of the pre-vocational schools. Model 6 shows that no significant interaction-effect was found between the secondary schools types and the type of professional community school clusters. It could therefore be concluded that *Professional Community* schools have a positive relationship with student achievement, independent of the school type.

3 Even though these school predictors explained 30% of the variance, in Model 3 the unexplained school variance left is still around 40%, determined mainly by the fact that in the Dutch secondary education, the difference is situated more between educational tracks within schools than between schools.

Table 6. Modeling the effects of professional community factors on student achievement

Models	1 Empty	2 Student	3 School	4 PC	5 Cluster PC	6 Interaction
Intercept	-.15 (.09)	-.57 (.10)**	-.83 (.11)**	-.88 (.11)**	1.46 (.27)**	-1.29 (.30)**
Gender		.18 (.02)**	.18 (.02)**	.18 (.02)**	.18 (.02)**	.18 (.02)**
Ethnicity		.20 (.04)**	.20 (.04)**	.20 (.04)**	.20 (.04)**	.20 (.04)**
Nationality		.17 (.06)*	.17 (.06)**	.17 (.06)*	.17 (.06)*	.17 (.06)*
School type/Baseline VMBO						
VWO/HAVO			.67 (.15)**	.61 (.14)**	.66 (.14)**	.37 (.52)
Schools' economic background			-.27 (.08)**	-.22 (.07)**	-.26 (.08)**	-.26 (.08)**
Schools' nationality background	.		15 (.06)*	.15 (.06)*	.15 (.06)*	.15 (.06)*
Reflective dialogue				.04 (.06)		
Collaborative activity				-.06 (.06)		
Deprivatization of practice				-.14 (.08)		
Shared sense of purpose				.07 (.05)		
Focus on student learning				.14 (.06)*		
Clusters' effect/Baseline Cluster 2 DEP						
Cluster 1 Professional community					.72 (.29)*	.39 (.33)
Cluster 3 Collaborative activity					.52 (.28)	.34 (.32)

Table 6. Modeling the effects of professional community factors on student achievement (continued)

Cluster 4 Non-professional community					.59 (.30)	.53 (.35)
Cluster 1 Professional Community	* School type					.54 (.54)
Cluster 3 Collaborative Activity	* School type					.30 (.55)
Cluster 4 Non-Professional Community	* School type					.09 (.57)
School variance	.76 (.87)	.75 (.87)	.42 (.65)	.37 (.61)	.38 (.62)	.39 (.62)
Student variance	.31 (.56)	.29 (.54)	.29 (.54)	.29 (.54)	.29 (.54)	.29 (.54)
Unique Explained variance		2%	30%	7%	5%	0%
Effect size				.24	.20	

Notes. *N student level*= 2706; *N school level*= 117; Fixed coefficients are followed by their standard error. *$p < .05$. ** $p < .01$

Discussion and conclusion

A relevant question is which specific characteristics of departments make them more effective. Qualitative research shows that teachers' collaborative approaches within departments relate with effective schools (Harris et al., 1995; Little, 1995; McLaughlin & Talbert, 2001). Moreover, quantitative research shows that schools where teachers work in professional communities are associated with higher student achievement (e.g., Lee & Smith, 1996; Louis & Marks, 1998; Newmann et al., 1996). In addition, our study adds to this knowledge by (a) using a more precise measurement of department professional communities as defined by the five characteristics, namely *reflective dialogue, collaborative activity, practice deprivatization, a shared sense of purpose,* and *a focus on student learning*, and (b) by investigating their relationship with student achievement using quantitative methods of research.

Regarding the Dutch literature, most studies on school departments and their relationship with student achievement were conducted in the 1990s, indicating that most departments could hardly be considered as professional communities (Witziers, 1992). Given the educational reforms at the time, which reinforced the role of departments in introducing change, we were particularly interested in establishing whether the departments in Dutch secondary schools have actually developed into professional communities during the last decade and if this had any relationship with student achievement. This is an important inquiry with applications in all educational systems that are focused on student success.
In this context, our *first* research question dealt with how much math departments work as professional communities. Our research results show that the math professional communities are relatively well developed, especially concerning the *shared vision* and *focus on student learning* aspects. The descriptive results illustrate that of the five professional community characteristics, at least one represents a focal point in the way of working of 73% of the teachers in our sample. Explicitly, 87% of the teachers indicated that sharing the same purpose was an important objective and 83% of the teachers considered the focus on student achievement as essential. Lee and Smith (1996) also found collective responsibility for learning to have consistent positive effects on student achievement, especially when it came to mathematics. In our study, this relatively high presence also applied to reflection on teaching practices for 79% of the teachers, and collaboration in developing teaching materials for 58% of them. The deprivatization of practice characteristic was reported by only 13% of the sample. This finding is in line with that of Witziers (1992), which shows that even in strong professional school departments, teachers only occasionally observe one another's teaching practices. Still, the results seem to indicate that departments act more as professional communities when compared to a few decades ago.

Our *second* research question was focused on the issue whether schools could be classified into categories based on their degree of the specific characteristics of professional communities, and whether professional community schools could be associated with strong or successful schools. The results of the cluster analysis, based on the professional community characteristics, confirmed that schools can be classified into several categories, namely *Professional Community* schools (34% of our sample), *Deprivatization of practice* schools (11% of our sample), *Collaborative activity* schools (28% of our sample) and *Non-Professional Community* schools (27% of our sample). It appeared that the mean score of *Professional community* schools on the student achievement item was high and positive (.33[.79]), whereas that of the *Non-Professional Community* schools was low and negative (.14[.84]). In summary, the 40 *Professional Community* schools with the highest scores on the characteristics of professional community were also the schools with the highest scores on student achievement, and thereby considered as successful schools. Our findings end up supporting the results found by Newmann and Wehlage (1995), that a professional community focused environment characterizes successful schools.

Our *third* research question dealt with the relationship between professional community and student achievement. After controlling for important variables at student and teacher/school levels, an additional 7% of the variance among schools was explained by the presence of the five characteristics of professional community, with an effect size of .24, which could be considered as small (Cohen, 1989). Considering that this is a school effect, a 7% additional explained variance is important. However, only the *focus on student learning* had a positive effect, indicating that higher expectations of teachers with respect to the success of their students are associated with higher levels of student achievement. Bolam et al. (2005) also found pupil learning ethos to have a positive relationship to pupil outcomes. Moreover, this positive effect has been associated with this commonly recognized predictor of student success in the research domain of educational effectiveness (Scheerens & Bosker, 1997).

We expected stronger effects of reflective dialogue or collaboration, but no such effects were found. Similar trends were also observed in the studies of Lee and Smith (1996), and Visscher and Witziers (2004), who explained that the effects of interaction between teachers are likely to be indirect.

When including in the analysis the schools classified into clusters on the basis of their degree of the professional community characteristics, 5% of the variance among the schools was explained, with an effect size of .20, which is also small (Cohen, 1989). The goal of this analysis was to investigate whether *Professional Community* school label (applying to 40 schools in our study) is a predictor of student success as opposed to the other school clusters. The results indicated that this was indeed the case; *Professional Community* schools had a positive significant relationship with student achievement, whereas the other categories

of schools did not. The explanation for this significant result with respect to this specific category of schools is that their departments consistently integrate their focus on student achievement into their shared purpose, reflection, and collaboration. In this respect, Witziers (1992) also confirmed that mathematics departments with a strong educational focus on professional community activities are associated with higher student achievement levels. Considering that only *Professional Community* schools made a significant contribution on student achievement scores, the .20 effect size found would appear to single out professional community as a relevant predictor of the variance among schools.

In our study, we have presented the additional finding that schools where the mathematic departments work as professional communities are related to higher student achievement, independent of their type: *pre-vocational* (VMBO) or the *majority of more academically focused schools*. However, in our study we were not able to investigate the individual impact of the three educational levels (VMBO vs HAVO vs VWO). For future research, it would be interesting to investigate if teachers in highest educational level (VWO) tend to organize their common work more in professional communities than those in the HAVO and VMBO schools.

To summarize, the nature of the mathematics departments in terms of their specific professional community characteristics explained 7% of the variance between schools, with an effect size of .24, indicating an effect on the school level. In addition, the schools that were more professional in terms of their community activities were associated with higher student achievement scores.

There are two limitations to this study, which, building on our findings, create new premises for research. The first limitation is the attention given to departments as opposed to schools as professional communities. Authors like Little (1993), and Talbert and McLaughlin (2002) pointed out possible tensions that could appear between these two forms of communities, caused by the fact that teachers' perceptions of students or their teaching practices might be influenced by their experiences within the departmental communities. However, our study does offer an extrapolated perspective from departments to school characteristics, by performing the cluster analysis and grouping the schools based on their professional community traits, which explains 5% of the variance among schools and offers a generalized school picture in an explicit fashion. A future study, however, might well investigate which perspective on professional community (school or department) fits the best to secondary schools and which of them are related to different kinds of outcomes, such as language or social outcomes.

The second limitation of this study lays in measuring student achievement at one point in time, which did not allow establishing whether strong professional communities lead to

higher levels of achievement and vice-versa. This indicates a need for longitudinal student achievement data in order to evaluate the long-term impact of professional community and to provide detailed information for educators on how to improve their work. Furthermore, combining longitudinal achievement data with more in-depth research into the indirect effects (Bryk et al., 1999) could provide essential knowledge about the broad and complex context in which teachers work.

Appendix 1.

Table 2. Professional community items in TIMSS questionnaire, compared with items from instruments used in previous leading research

Five-factors definition	TIMSS questions	The questions in previous questionnaires
Reflective dialogue	How often do you discuss how to teach a particular concept	Bryk, Camburn, and Louis (1999) How often the teachers discuss assumptions of teaching and learning? Bryk, Camburn, and Louis (1999) How often have you conversations about instruction in the teachers' lounge, faculty meetings, etc?
Collaborative activity	How often do you working on preparing instructional materials	Bryk, Camburn, and Louis (1999) Teachers design instructional programs togetherLouis and Marks (1998) How often do you receive useful suggestions for curriculum materials from colleagues in your department?
Deprivatization of practice	How often do you visit another teachers' classroom to observe his/her teaching	Louis and Marks (1998) How often have you visited teachers' classroom to observe and discuss their teaching? Wahlstrom and Louis (2008) How often in this school year, have you visited other teachers' classrooms to observe instruction?
Shared sense of purpose	How would you characterize teachers' understanding of the schools' curricular goals	Louis (2006) Had conversations with colleagues about the goals of this school? Louis and Marks (1998) Goals and priorities for the school are clear. Wahlstrom and Louis (2008) How often in this school year, have you had conversations with colleagues about development of new curriculum?
Focus on student learning	How would you characterize teachers' expectations for student achievement	Bryk, Camburn, and Louis (1999) This school has well-defined learning expectations for all students. Wahlstrom and Louis (2008) In our school, we have well defined learning expectations for all students.

CHAPTER 4.

Conceptualization, measurement and validation of the professional community concept.

Conceptualization, measurement and validation of the professional community concept[1]

Abstract

The concept of professional community has proven difficult to define and measure, while the need for formulating a common approach to both its conceptualization and measurement is fundamental. Haven taken the concept's multidimensionality as our point of departure, we present a comprehensive review especially focused on its definitions and measurements. This literature review is based on three development phases covering a time span of thirty years. In the temporal overview of the development of professional community, we listed the instruments designed for measuring the concept, which were obtained from more than 60 articles. We selected eight measurement tools and analyzed them on the basis of specific criteria. The *Teachers' Professional Community* index (15 items, 4 sub-dimensions) of Wahlstrom and Louis (2008, p.487) best met most of the analysis criteria. Therefore, this study presents and discusses the results and implications of the confirmatory factor and the reliability analyses performed on two stratified subsamples of respectively 102 and 95 teachers in Dutch secondary schools. The results offer empirical support for a multidimensional definition and operationalization of the concept and its latent constructs. In conclusion, by refocusing on both the concept and its measurements, we have aimed at opening up the discussion about the sub-dimensions of a construct considered until now as rather *fuzzy*, thereby creating opportunities for evaluating the impact of professional communities within a broader international framework.

Keywords: professional community; instrument validation; conceptualization; confirmatory factor analysis

1 Based on Lomos, C., Hofman, R. H., & Bosker, R. J. (under review). Conceptualization, measurement and validation of the professional community concept. *Submitted.*

Introduction

The concept of professional community has proven difficult to define and measure, due to both the large number of different theoretical perspectives applied (e.g. Croninger & Malen, 2002; Fallon & Barnett, 2009) and its relevance to a broad educational context (Stoll & Louis, 2007). An entire spectrum of different terms is being used to describe the concept (Toole & Louis, 2002) and in various educational settings its meaning has been generalized (Beck, 1999). The most representative example of this theoretical generalization is the interchangeable use of the terms *professional community* and *professional learning community* in both theory and research, especially in the last decade indicating "a shift in the emphasis away from a focus on process towards objective of improvement" (Stoll & Louis, 2007, p.2). In addition, many authors differentiate between school-based and department-based professional communities, especially in secondary education (e.g. Talbert & McLaughlin, 1994; Siskin, 1994), where teachers' work is mainly organized around the specific subjects they teach. This conceptual ambiguity has also been associated with the difficulty of operationalizing and measuring the concept, a struggle that continues today.
However, given the theoretical as well as the empirical evidence, the most commonly used definition of professional community is based on a multidimensional perspective, where the concept is defined using more than one characteristic. When measuring the concept from this multidimensional perspective, there are multiple sub-dimensions available, such as *reflective dialogue, deprivatization of practice* or *feedback on instruction, collaborative activity* or *collaboration, shared sense of purpose* or *collective responsibility,* and *a (collective) focus on student learning*. All these sub-dimensions belong to one instrument, as employed in many empirical studies (e.g. Bryk, Camburn, & Louis, 1994; Louis & Marks, 1998; Marks & Louis, 1997; Newmann & Wehlage, 1995; Newmann, Marks, & Gamoran, 1996; Smylie, Wenzel et al., 2003; Tighe, Wang, & Foley, 2002).

In this context, the present article aims at investigating the psychometric properties and construct validity of such an instrument for measuring professional community in Dutch secondary schools. Given the concept's comprehensiveness and the frequency with which it is debated, a complex literature search was performed to identify the most appropriate instrument to be adapted and field-tested, with a specific focus on studies that investigated the relations of professional community with student achievement. The instrument selected was tested within a Dutch educational context. This article presents and discusses the results of the confirmatory factor analysis and the reliability analysis. First, in the theoretical background section we give a comprehensive overview of the main instruments developed to measure the professional community concept, mainly in relation with student achievement. Next, on the basis of this information we selected the most appropriate instrument to be validated.

Theoretical background

The professional community concept has gone through a long development process that can be divided into three consecutive periods (Lomos, Hofman, & Bosker, in press), namely its definition phase, its operationalization and measurement phase and its assessment of effectiveness phase. This temporal perspective has provided an overview of instruments to measure the concept, as presented next.

The definition phase (1982 - 1994)

The first research period started around 1982, with the work of Little (1982), and continued until around the year 1994. This research period could be considered as the beginning of the process of defining the professional community concept. Initially, the following terms were used to describe teachers' work: "collegiality" (Little, 1982), "collegial interaction and teacher community" (Talbert & McLaughlin, 1994), "supportive collegial group" (Rosenholtz, 1985), "teachers' collaboration with colleagues" (Rosenholtz, Bassler, & Hoover-Dempsey, 1986) and "communal school organization" (Bryk & Driscoll, 1988). At the end of this research period, the specific characteristics of teachers' work became more associated with the professional community concept, namely the school's vision and values, providing feedback on colleagues' work and behavior, cooperating in instructional tasks and agreeing upon a common focus on student learning (Hord, 1997; McLaughlin, 1992).

Given the theoretical focus on teacher collaboration and professional community during this research period, many studies performed were qualitative (e.g. Little, 1982; Rosenholtz, 1985; Siskin, 1994) based on interviews, observations, or the use of focus groups to investigate the "workplace conditions of school success" (Little, 1982, p.325). Although most research was qualitative, within this period some instruments were developed and implemented (e.g. Chubb, 1988; Corcoran, 1985; Fullan & Stiegelbauer, 1991; McLaughlin, 1992; Rosenholtz, 1989), which mainly measured the concept as one dimension. A first example is the study of Rosenholtz, Bassler and Hoover-Dempsey (1986), who used an instrument with two scales, namely faculty collaboration and instructional coordination. In 1990, Rosenholtz and Simpson proposed an instrument for measuring teachers' learning opportunities. In addition, the work of Newmann, Rutter and Smith (1989) and Bryk and Driscoll (1988) focused on elaborating and testing a community index as a representation of schools' sense of community and social organization. To Newmann, Rutter and Smith (1989), a sense of community meant close relationships between teachers as well as cooperation and collegial assistance with the aim of boosting student achievement. Bryk and Driscoll (1988) used a "sense of community" index that included teachers' agreement on schools goals, beliefs and values, cooperation, and organizational characteristics. To continue, Siskin (1994) also used a number of items focused on collegiality, assessing the number of staff members that help

each other, cooperate, and are committed to maintaining high standards. In addition, Talbert and McLaughlin (1994) tested a teacher community index to assess colleagues' support for learning new ideas and realizing professional growth.

The operationalization and measurement phase (1995 - 2004)

The second research period is representative of the process of operationalizing and measuring the concept. This period especially refers to the evaluation of the comprehensive school reform programs in the USA in the 1990s (e.g. Andrews & Lewis, 2001; D'Amico, Harwell, Stein and van den Heuvel, 2001; Hausman & Goldring, 2001; Olivier, Hipp, & Huffman, 2003; Johnson, 2003; Lauer & Dean, 2004; Mulford, Silins, & Leithwood 2004; Talbert & McLaughlin, 2002; Tighe, Wang, & Foley, 2002). Moreover, more studies started to define and operationalize the professional community concept on the basis of the multidimensional perspective, considering its comprehensive applicability within schools, as presented next.

First, Louis, Marks, and Kruse (1995) tested a professional community index, organizing the items into several scales: shared sense of purpose, collaborative activity, collective focus on student learning, deprivatization of practice, and reflective dialogue (Louis & Marks, 1998; Marks & Louis, 1996). Continuing the multidimensional conceptualization perspective, Lee and Smith (1996) obtained three scales to evaluate the professional community concept as a reform measure, namely cooperation and support among teachers, collective responsibility for student learning, and teacher control. In addition, the Consortium on Chicago School Research at the University of Chicago (CCSR) developed and tested a number of instruments[2] to measure the concept longitudinally. One such study is that of Bryk, Camburn, and Louis (1999). They tested a comprehensive version of an instrument also based on the multidimensional perspective by again organizing the items into more than one scale, to be exact into the scales of collective responsibility for school operations and improvement, staff collaboration or collegiality, focus on student learning, deprivatized practice, reflective dialogue and teacher socialization. In addition, Hord (1997) elaborated, pre-tested and field-tested an instrument composed of five scales: shared vision focused on student learning, collective learning, shared leadership and decision-making, deprivatization of practice and feedback, and supporting school conditions and capacities (Hord, Meehan, Orletsky, & Sattes, 1999).

The Center for Research on the Context of Teaching (CRC) of the Stanford University specifically focused on professional learning community in relation to teacher learning. It developed and

2 In the 1999, 2001 and 2003 projects, professional community was measured using different scales: peer collaboration, collective responsibility, focus on student learning, and reflective dialogue (User's Manual, 2000; 2004)

tested several instruments that included scales[3] (McLaughlin & Talbert, 2003) such as teacher learning community, collegiality, teacher knowledge sharing, classroom observation, and collaboration. Continuing the evaluation of the reform processes in the USA, Supovitz (2002) tested an instrument with one scale for assessing team group instructional practices. In addition, Smylie, Wenzel et al. (2003) evaluated professional community by using six scales: collective responsibility, peer collaboration, focus on student learning, reflective dialogue, orientation towards innovation, and teacher commitment to school.

Regarding department professional communities in secondary schools, authors like Wiley (2001) as well as Visscher and Witziers (2004) concentrated on mathematics professional communities and their relation with student achievement. More specifically, Wiley (2001) constructed one scale to assess the presence of shared goals, teacher collaboration, teacher learning, and cooperative focus on the improvement of teaching to increase student mathematics learning, while Visscher and Witziers (2004) used six overarching scales, namely consensus, consultation and cooperation, policy and evaluation, decision-making, school leadership and departmental leadership, with more than 20 subscales.

The implementation and conditions phase (2004-2009)

The third research period started around the year 2004. It has been mainly focused on the process of developing and sustaining effective professional learning communities (e.g. Chapman et al., 2000; Cranston, 2009; Hargreaves, 2007; Elbousty & Bratt, 2010; Hipp & Huffman, 2007; Kruse & Louis, 2007; McLaughlin & Talbert, 2007; Ricketts, 2008; Stoll et al., 2006b). In addition, a more comprehensive approach has been adopted by an emphasis on the facilitating conditions within schools (e.g. Goldring, Huff, Spillane, & Barnes, 2009; Halverson, 2007; Sleegers, Bolhuis, & Geijsel, 2005). Some studies have measured the internal and external facilitating conditions as part of the professional learning community concept (e.g. Reichstetter & Baenen, 2007; Thomas, 2010), while other authors consider these conditions as external facilitators of the concept (e.g. Ingvarson, Meiers, & Beavis, 2005; Louis, Dretzke, & Wahlstrom, 2010; Wahlstrom & Louis, 2008). This research period can be characterized by a continuation of the empirical research aimed at developing instruments to measure the professional learning community concept (e.g. Bolam et al., 2005; DuFour, DuFour, Eaker, & Many, 2006; Goldring, Huff, Spillane, & Barnes, 2009; Grimmet & D'Amico, 2008; Hirsh, 2006; Pedder, James, & MacBeath, 2005; Reichstetter & Baenen, 2007), as presented next.

3 The scales were part of comprehensive questionnaires in three projects, namely the OERI project (1987 – 1992) focused on secondary schools' context conditions, the CTP project (1997-2003) in collaboration with the Center for Teaching and Policy, and the Evaluation of Bay Area School Reform Collaborative project (BASRC) (1996-2001 and 2001-2006). The instruments and scales developed can be found on the CRC (2005) website and the results are presented in different reports and associated articles (e.g. McLaughlin & Talbert, 2003; McLaughlin & Talbert, 2006).

One example is a study by Bolam et al. (2005), who investigated the process of creating and sustaining effective professional learning communities and their relationship with student achievement. For measuring the concept, they obtained four scales: professional and pupil-learning ethos; within-school policy, management, and support for professional learning; enquiry orientation; and participation of non-teaching support staff (Bolam et al., 2005; Thomas, 2010). In addition, DuFour and colleagues (e.g. DuFour, 2004; DuFour & Eaker, 1998; DuFour, DuFour, & Eaker, 2008) developed an instrument[4] referring to collaboration and collective inquiry, shared knowledge, student work and achievement targets, common achievement goals and norms, time for team-meetings and feedback. Finally, a quite recent study by Wahlstrom and Louis (2008) used four scales: shared norms, collective responsibility, deprivatization of practice, and reflective dialogue.

In conclusion, the instruments used in different empirical studies illustrate the processes of operationalizing and measuring professional community. Next, we present the process of selecting the most appropriate instrument to be validated in Dutch secondary education.

Selecting the appropriate instrument for validation

In order to identify the most appropriate instrument to measure the concept of professional community in our present study, an analysis of the available instruments was performed. We conducted the literature search between 2007 and 2008, during which time we selected 62 articles that made any mention of the development of an instrument to measure the professional community concept. First, the articles that included item-related information were considered for the analysis. In a next step, we requested a total of 48 authors by email[5] to send us the descriptions of their instruments that had not been presented in full detail in their articles. Of the 29 authors who responded, 8 of them sent their instruments and additional reliability information. The other 21 authors sent useful suggestions for literature while indicating that they had not used a specific professional community instrument.

For selecting the most appropriate instrument to test it in the Dutch educational context, specific criteria were formulated. Our first essential selection criterion was in line with the multidimensional perspective, namely that the professional community concept had to be measured using more than one underlying sub-dimension, which determined the exclusion of studies such as Talbert and McLaughlin (1994), Supovitz (2002) or Wiley (2001). The instruments that met this criterion were, chronologically: Louis, Marks, and Kruse (1995); Lee and Smith (1996); Bryk, Camburn, and Louis (1999); Hord, Meehan, Orletsky and Sattes

4 On the AllThingsPLC website (2011) different tools for assessing professional learning community are shown, such as a 'survey on team norms', a 'collaborative culture worksheet', a 'team feedback sheet' and other items.

5 The complete list of authors can be provided on request.

(1999); Smylie, Wenzel et al. (2003); Visscher and Witziers, 2004; Bolam et al. (2005) and Wahlstrom and Louis (2008). To continue, the chosen instrument had to be a recent one, with a strong theoretical and empirical base, purposely developed to measure the concept from teachers' perspectives of school-based professional community in secondary schools. In addition, the reliability and validity indicators of the scale and subscales had to be satisfactory.

Table 1 lists the eight instruments that met the specific analysis criteria. It also contains the additional information. As columns two and three show, all instruments selected contained more than one sub-dimension to assess the characteristics of professional community. Table 1 shows also the instruments in chronological order to indicate how recent they are. The most recent instrument is that of Wahlstrom and Louis (2008), and most of them have a strong theoretical and empirical foundation.

More specifically, the Wahlstrom and Louis (2008) instrument was used in an earlier study by Louis, Marks and Kruse (1995), the instrument of Hord, Meehan, Orletsky and Sattes (1999) is based on a comprehensive literature review, while the instruments of Bryk, Camburn and Louis (1999) and Smylie, Wenzel et al. (2003) are built upon longitudinal investigations and testing. However, only Wahlstrom and Louis (2008), Hord, Meehan, Orletsky and Sattes (1999), Visscher and Witziers (2004), and Bolam et al. (2005) present an instrument purposely designed to measure the professional community concept. With respect to the data source presented in column 4 of Table 1, only Bolam et al. (2005) used principals' perceptions, which determined the specific of the items and scales used. Furthermore, only the study of Visscher and Witziers (2004) measured professional community as a department-based characteristic, and Smylie, Wenzel, et al. (2003) focused explicitly on primary education. Moreover, Hord, Meehan, Orletsky and Sattes (1999) did not provide explicit empirical evidence by testing its associations with other related concepts. The final criteria concern the reliability and validity information presented in columns five and six of Table 1. The instrument of Wahlstrom and Louis (2008) had the highest Cronbach alpha values for the scales (between .76 and .87), together with the instrument of Smylie, Wenzel et al. (2003) (between .75 and .92). To conclude, by using factor analysis and including the loading information, all studies proved the capacity of the instruments to measures the multidimensional character of the professional community concept.

Table 1. The analysis of the instruments selected

Instrument Year	The scales	Scales, subscales and length	Data source Sample size	Internal consistency	Construct validity
Professional Community Index Louis, Marks and Kruse (1995)	Professional Community Index	1 scale; 20 items	Teachers: 910 Schools: 24	Cronbach α = .69	Factor analysis (p. 769)
	1. Shared sense of purpose	1 subscale; 3 items		Cronbach α = .74	
	2. Collaborative activity	1 subscale; 6 items		Cronbach α = .68	
	3. Collective focus on student learning	1 subscale; 4 items		Cronbach α = .61	
	4. Deprivatized practice	1 subscale; 4 items		Cronbach α = .62	
	5. Reflective dialogue	1 subscale; 3 items		Cronbach α = .68	
Professional Community Lee and Smith (1996)	1. Collective responsibility for student learning	1 factor; 12 items	Teachers: 9,904 Schools: 820	Cronbach α = .77	Factor analysis (p.134) The association between the three measures (p.141)
	2. Cooperation and support among teachers	1 factor; 14 items		Cronbach α = .87	
	3. Teacher control	1 factor; 9 items		Cronbach α = .76	
Professional Community Composite Bryk, Camburn and Louis (1999)	Professional Community Composite	1 composite; 31 items	Teachers: 5,690 Schools: 248	Loaded strongly on one factor Cronbach α = .90	Rash-rating scale model (p. 760; p. 763) Factor analysis (p. 762)
	1. Collective responsibility for school operations and improvement	1 subscale; 6 items			
	2. Staff collegiality/collaboration	1 subscale; 4 items		Cronbach α = .75	
	3. Focus on student learning	1 subscale; 5 items		Cronbach α = .84	
	4. Deprivatized practice	1 subscale; 5 items		Cronbach α = .70	
	5. Reflective dialogue	1 subscale; 9 items		Cronbach α = .85	
	6. Teacher socialization	1 subscale; 2 items		Cronbach α = .60	

Table 1. The analysis of the instruments selected (continued)

Descriptors of Professional Learning Communities Hord, Meehan, Orletsky and Sattes (1999)	Descriptors of Professional Learning Communities 1. The collegial and facilitative participation of the principal, who shares leadership and decision making with the staff 2. A shared vision that is developed from the staffs unswerving commitment to students' learning 3. Learning that is done collectively to create solutions that address students' needs 4. The visitation and review of each teacher's classroom practices by peers as a feedback and assistance activity to support individual and community improvement 5. Physical conditions and human capacities that support such an operation	1 scale; 17 items 1 subscale; 2 items 1 subscale; 3 items 1 subscale; 5 items 1 subscale; 2 items 1 subscale; 5 items	Teachers: 690 Schools: 21	Cronbach α = .94	Factor analysis (p. 7) The scores of the teachers in the schools known for strong professional learning community functioning were compared to the new scores (p. 7).
Teacher Professional Community Smylie, Wenzel et al. (2003)	1. Collective responsibility 2. Peer collaboration 3. Focus on student learning 4. Reflective dialogue 5. Teacher commitment to school 6. Orientation toward innovation	1 scale; 7 items 1 scale; 4 items 1 scale; 5 items 1 scale; 7 items 1 scale; 4 items 1 scale; 6 items	Teachers: 8,572 Schools: 365	Cronbach α = .92 Cronbach α = .75 Cronbach α = .81 Cronbach α = .78 Cronbach α = .79 Cronbach α = .89	Rasch measures (p. 168) The measures were used in surveys in 1994, 1997, 1999 and 2001 (p.168).

Table 1. The analysis of the instruments selected (continued)

Professional communities Visscher & Witziers (2004)	1. Consensus 2. Consultation and cooperation 3. Departmental policy and evaluation 4. Decision making 5. School leadership 6. Head of department	4 subscales; 41 items 5 subscales; 51 items 4 subscales; 32 items 2 subscales; 28 items 4 subscales; 65 items 2 subscales; 17 items	Teachers and heads of department : 169 Schools : 39	Cronbach α ≥ .74 Cronbach α ≥ .82 Cronbach α ≥ .73 Cronbach α ≥ .86 Cronbach α ≥ .78 Cronbach α ≥ .79	Other related traits of professional community (p. 792) Factor analysis (p. 791)
Indicators of Professional Learning Communities Bolam et al. (2005)	1. Professional and pupil learning ethos 2. Within school policy, management and support for professional learning 3. Enquiry orientation (external and internal) 4. Participation of nonteaching staff in professional learning community	1 factor; 21 items 1 factor; 9 items 1 factor; 5 items 1 factor; 8 items	Principals: 393 Schools: 393	Cronbach α > .70 Cronbach α > .70 Cronbach α > .70 Cronbach α > .70	Factor analysis (p. 37) Tested in different phases of education (primary or secondary) (p. 34) Tested in different types of contexts (p. 46)
Teacher's Professional Community Wahlstrom and Louis (2008)	1. Shared norms 2. Deprivatized practice 3. Reflective dialogue 4. Collective responsibility	1 factor; 4 items 1 factor; 4 items 1 factor; 5 items 1 factor; 3 items	Teachers: 4,165 Schools: 39	Cronbach α = .76 Cronbach α = .80 Cronbach α = .87 Cronbach α = .85	Factor analysis (p. 471; p. 488)

Based on our findings presented in Table 1, we concluded that the *Teacher's Professional Community* instrument of Wahlstrom & Louis (2008, p. 487) met most of the analysis criteria. The arguments to support this finding were that this instrument measured the concept using more than one scale/sub-dimension and that it had a strong theoretical base since it was pre-tested in previous studies (e.g. Louis, Marks, & Kruse, 1995). In addition, it was developed to measure the concept and has the most satisfactory reliability indices as well as adequate construct validity. In brief, the instrument chosen to be adapted to the Dutch educational context had 15 items organized in four scales/ sub-dimensions: *shared norms, deprivatization of practice, reflective dialogue* and *collective responsibility*, with alpha values higher than .75 per scale.

Model specification

Given the above analysis of the information collected in Table 1, our choice of the instrument to be validated to a different educational context was the Wahlstrom and Louis *Teacher's Professional Community* model (2008, p. 487).

However, two adaptations were necessary to be able to measure the concept of professional community the most effectively. The first concerned the scale of *shared norms*. This scale was not so common, and apart from Wahlstrom and Louis, only Hord, Meehan, Orletsky and Sattes (1999) used it. It referred to the facilitative participation of the principal, containing items referring to the role of the principal and a focus on student learning. These aspects were difficult to integrate into one scale and some authors argued for necessary evidence of professional community measured separately from leadership (Wiley, 2001). Therefore, we excluded the four items of shared norms from the final instrument, resulting in a final measure consisting of 12 items organized in three scales/ sub-dimensions: *deprivatized practice, reflective dialogue* and *collective responsibility,* with Cronbach alpha values higher than .85. The second adaptation regarded the *focus on student learning* items, which appear in all instruments presented in Table 1, since student performance is in theory considered as the main outcome of professional community. This is why we added a four-item scale of *focus on student learning*. In our choice of the most suitable items for this scale, there were four options: the study of Bryk, Camburn and Louis (1999) (5 items, α = .84, 5,690 teachers), that of Louis, Marks, and Kruse (1995) (4 items, α = .61, 910 teachers), that of Smylie, Wenzel et al.[6](5 items, α = .81, 8,572 teachers) and that of Hendriks and Bosker (2003) [7] (3 items, α = .68, 1,366 teachers).

6 The three studies used individual scales for Focus on student learning, as presented in Table 1.

7 The zebo study (2002)

Because the study of Hendriks and Bosker (2003) was conduced in Dutch schools, while the items of the scale used in this study were very similar to the ones in the three other studies (see Appendix 1, Table 2 for more details) and their Cronbach alpha value was satisfactory, we chose the items of Hendriks and Bosker (2003).

To summarize, our model to be tested contains 15 observed variables or items organized in four latent variables or scales, namely *deprivatization of practice, reflective dialogue, collective responsibility,* and *focus on student learning*. Following Bryk, Camburn, and Louis (1999), the *deprivatization of practice* scale reflects how frequently teachers observe each other's classes for providing feedback; *reflective dialogue* indicates whether teachers communicate about issues such as instruction and student learning; *collective responsibility* focuses on the shared responsibility among teachers to improve the day-to-day operations; and *focus on student learning* refers to the extent to which teacher work is directed at facilitating student learning. Appendix 1, Table 3 presents the final questionnaire to be tested, with the items [8] organized in the specific scales. All variables were considered as continuous and all answers were based on self-report.

Method section

Data source

The data for this study was collected during the academic year 2008 – 2009, as part of the evaluation process of new Dutch legislation targeted at all secondary schools in the Netherlands (Spijkerboer, Hofman, Doolaard, & Van de Werf, 2009). In our study, 69 schools agreed to participate, a representative sample on the basis of four main school characteristics (e.g. type of secondary school, number of students per school, denomination, and educational vision) (Spijkerboer, Hofman, Doolaard, & Van de Werf, 2009). In addition, of the 69 schools participating a total of 198 teachers in 56 schools completed the professional community questionnaire, amounting to a response rate of 59% (Spijkerboer, Hofman, Doolaard, & Van de Werf, 2009). These teachers taught different subjects and were active in all tracks of secondary education.

Research design and methods of analysis

Because the original instrument was in English, a translation into Dutch language was required, which was made by three Dutch academic researchers with experience in school-

8 The 12 items assigned to the deprivatized practice, reflective dialogue, and collective responsibility scales were measured using a Likert-type five-point scale. Here the participants were asked to rate how often they performed a specific activity, the scale ranging from never to always. The 3 items assigned to the focus on student learning scale were measured using a Likert-type four-point scale, ranging from strongly disagree to strongly agree.

based research. In performing this task, specific attention was paid to how the concepts would be understood and experienced by teachers in general. The school leaders and the teachers in two secondary schools from two different regions inspected this version of the instrument and its underlying concept, and indicated that the instrument was clear in an open discussion with our researchers. To check for item-accuracy, the instrument was translated back into English without the help of the original scale and checked again. Next, in order to explore the instrument's stability in terms of its four-factor structure and the underlying one-component construct, Confirmatory Factor Analysis (CFA) was performed using the Maximum Likelihood estimation method (ML) in the M*plus* program (Muthén & Muthén, 2007). CFA was considered the appropriate method of analysis, considering the aim of evaluating the psychometric properties and construct validity of an instrument with strong underlying theoretical foundation (Harrington, 2009). In addition, we carried out reliability analysis to investigate the internal consistency of our instrument and its four scales.

Results

Confirmatory Factor Analysis

Input data

Before performing the CFA and in particular the ML estimation method, a few important issues had to be considered concerning the data, namely missing data, normality, and sample size (Harrington, 2009).

With respect to the missing data, one teacher who had missing data on one item was excluded from the final analysis. As a result, 197 teachers who fully completed the professional community questionnaire represented our final sample.

Multivariate normality implies that all variables are univariate normally distributed, which is assumed for the ML estimation method (Harrington, 2009). Inspecting for skewness and kurtosis is a way of checking for normality (Harrington, 2009). Table 3, in the Appendix, presents the skewness and kurtosis coefficients and standard errors. Considering that none of the variables had skew index absolute values higher than 3 and kurtosis absolute values higher than 10 (Kline, 2005, in Harrington, 2009), the data appeared to be sufficiently univariate normally distributed. Furthermore, none of the absolute values of the *z*-scores were higher than 4, indicating no significant outliers (Kline, 2005, in Harrington, 2009).
Given the expectation that model modifications were expected, a cross-validation of the instrument was necessary in order to avoid chance capitalization. To this end, the sample of 197 teachers was divided into two independent subsamples using stratified sampling. Taking

into consideration that the population consisted of teachers working in different tracks of secondary education, we had two subsamples of 102 and 95 teachers representing this factual proportion of educational tracks. There are no clear requirements for sample size, but some guidelines indicate that between 100 and 200 participants is a medium sample and appropriate for a model which is not too complex (Harrington, 2009). In this case, the subsamples' size of 102 and 95 teachers with no missing data was satisfactory for testing a model containing 15 observed variables, 4 latent variables and 1 main construct.

Model evaluation

Figure 1 presents the specified model to be tested. In order to evaluate how this 'one-component and a four-factor structure model' fits the first stratified subsample of 102 teachers, we will discuss the model fit chi-square statistic, the degrees of freedom, and significance levels. In addition, the fit indexes, the root mean square error of approximation and the standardized root mean square residuals are indicated (Harrington, 2009; Schreiber, Nora, Stage, Barlow, & King, 2006).

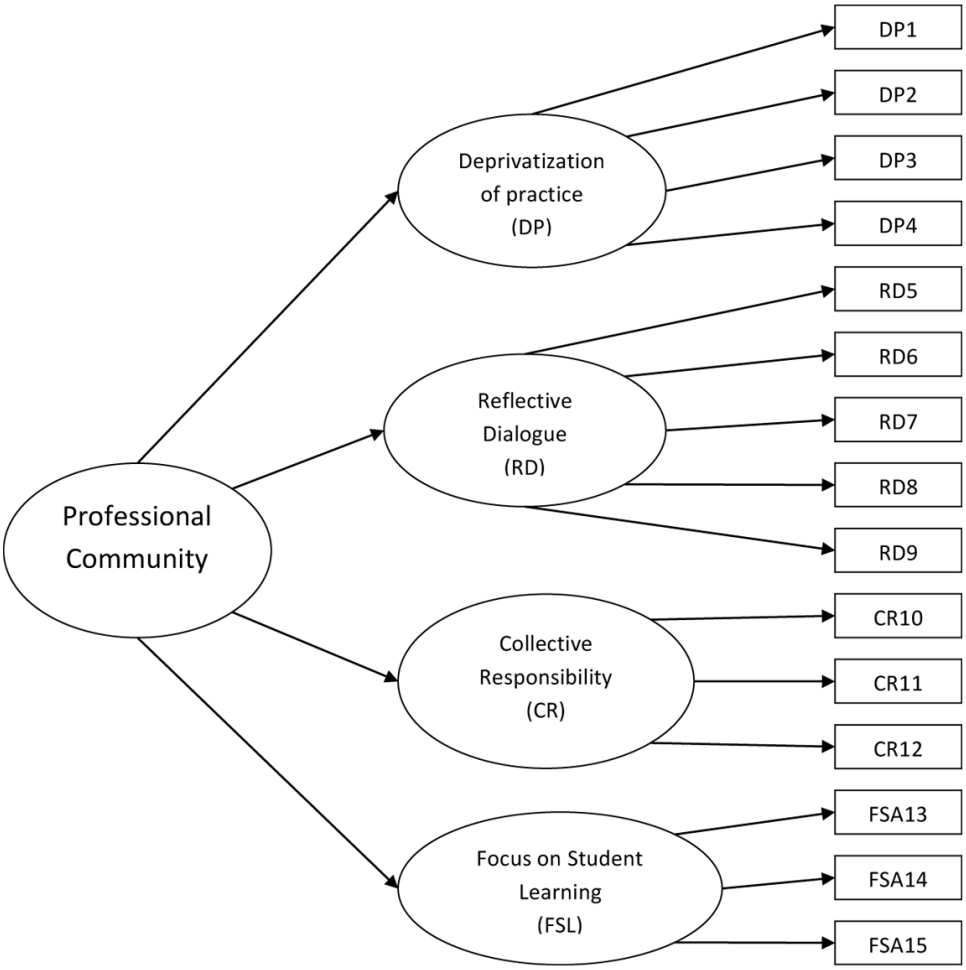


Figure 1. Professional Community Instrument - Model Specified

In terms of stability of the one-component and the four-factor structure, as presented in Figure 1, the model appeared not to fit well (χ^2 = 196.769 [df = 84; p < .0001], CFI = .706, TLI = .633, RMSEA = .115 with a 90% interval of .094 and .136, SRMR = .094). Considering that a good model fit has a fit index (CFI) and a Tucker-Lewis index (TLI) with values close to or higher than .95 (Schreiber et al., 2006), in our model, both indexes were smaller than .95. Moreover, a good model fit is characterized by a value for the root mean square error of approximation (RMSEA) smaller than .06 (Schreiber et al., 2006) and a value for the standardized root mean square residuals (SRMR) smaller than .08 (Schreiber et al., 2006). In the present model results, both conditions were not adequately met.

Figure 2 shows the standardized coefficients and the calculated standard errors that go with the standardized coefficients for all the relationships estimated in the model. First, when looking at the correlation coefficients between the four latent variables, it is clear that the first three latent variables correlated as expected. However, the fourth one did not correlate with the other three. Continuing with the coefficients for the factor loadings of the observed variables onto the latent variables, we can see that some variables loaded excellently above .70, some loaded well above .50 and two loaded slightly above .30 (Tabachnick & Fidell, 2007). The item with the lowest loading coefficient was item 5 of *reflective dialogue*, referring to the exchange of suggestions for curriculum materials between teachers. The last coefficients listed on the left hand side of Figure 2 are the squared multiple correlations for each observed variable, coefficients which indicate how much of the variance is accounted for by the latent variable (Harrington, 2009). The squared multiple correlations of the professional community items range from .03 to .64, indicating the lowest value for item 5 of *reflective dialogue*. Based on the squared multiple correlations, we could calculate the measurement error for each observed variable, indicating the unique variance not accounted for by the item belonging to the specific latent variable.

With respect to the poor model fit, the correlations between the four latent variables indicate that the *focus on student learning* is not related to the other latent variables, as shown in Figure 2. In addition, as indicated by the results of the second-order factor analysis presented in Figure 3, the standardized coefficients for the factor loadings of the latent variables on the main professional community construct indicate that *focus on student learning* did not load on the main construct either (χ^2 = 197.020 [df = 86; p < .0001], CFI = .711, TLI = .647, RMSEA = .112 with a 90% interval of .092 and .133, SRMR = .094).

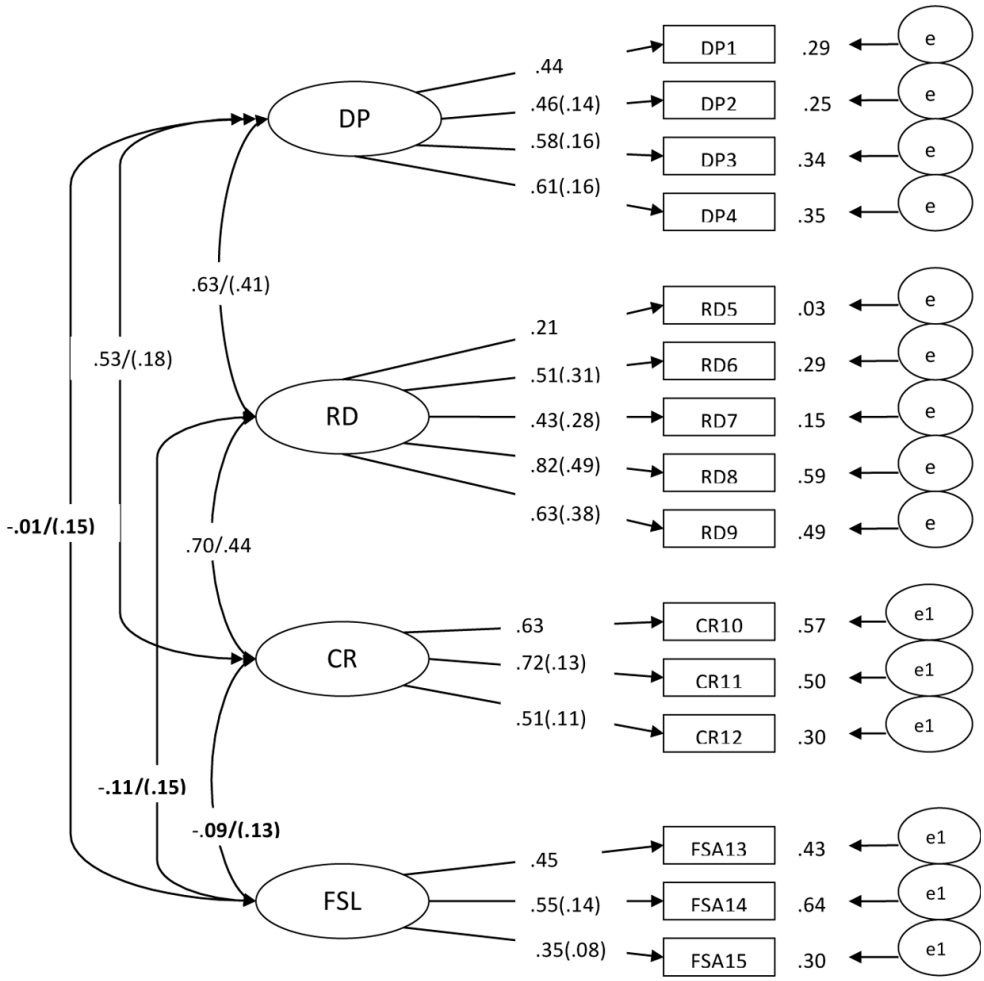


Figure 2. Professional Community Instrument - Model Evaluation

Note.

The figure indicates the standardized coefficients and the calculated standardized errors associated with the respective standardized coefficients

N=102 teachers – subsample 1;

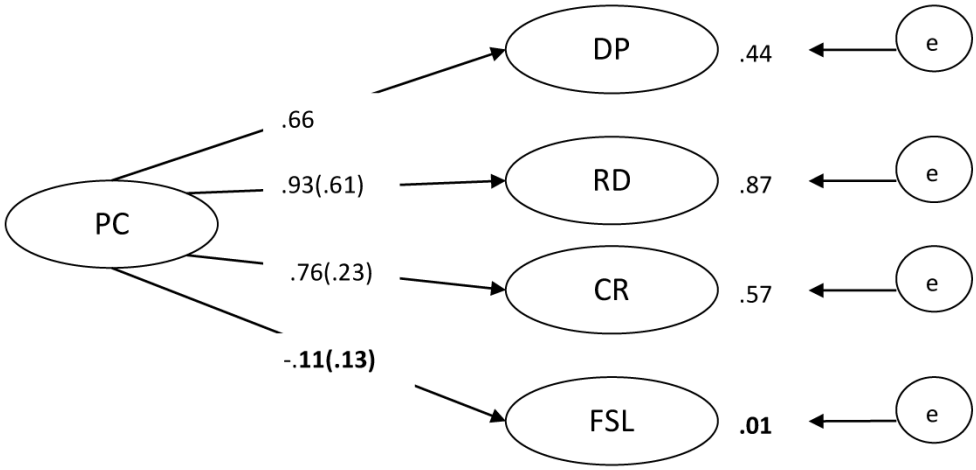


Figure 3. Professional Community Instrument - Second-order CFA

Note.

The figure indicates the standardized coefficients and the calculated standardized errors associated with the respective standardized coefficients.

N=102 teachers – subsample 1;

Model revision

Based on the results presented in Figures 2 and 3, the scale of focus on student learning was removed and a new model with 12 observed variables and 3 latent variables was tested again. The stability of the one-component and three-factor structure represented a model fit that was still modest, but obviously better than what had been the case (χ^2 = 128.264 [df = 51; $p < .0001$], CFI = .740, TLI = .663, RMSEA = .122 with a 90% interval of .096 and .148, SRMR = .100). The new model also showed a significant improvement in terms of the model fit chi-square statistic of 102.794, but also here both the absolute and the incremental fit indices indicated a modest model fit. In order to deal with this second area of poor fit referring to item 5 which loaded poorly on the latent variable, the model was re-specified by excluding this item, after which -however – there was still no improvement in model fit. Item 5 was nevertheless kept in the analysis in order to maintain the original composition of the scale.

Model re-specification

Another area of poor model fit was indicated by the model modification indices, which pointed at some significant correlations between the error terms of some of the observed variables belonging to the same latent variable. The model modification indices showed a significant correlation of error terms between variables 1 and 3, and 3 and 4 of "deprivatized practice", and between 5 and 7, 6 and 7, 6 and 8, and 8 and 9 of 'reflective dialogue'. The correlations between the error terms indicated that the variables were related because of something else rather than their belonging to the same latent variable or factor. Harrington (2009) points out that this other cause could be the similar wording of items, for example positive or negative. Considering that the phrasing of these items is similar as well as positive (see Table 3, Appendix 1), the error terms of these variables were allowed to correlate in the re-specified model.

In summary, with respect to the first subsample the final re-specified model showed a fair model fit in terms of degrees of freedom (χ^2 = 61.757 [df = 45; $p < .05$], CFI = .944, TLI = .917, RMSEA = .060 with a 90% interval of .004 and .095, SRMR = .067). It was composed of 12 observed variables organized in three latent variables as part of the main professional community construct, allowing correlations between only a few error terms.

Re-testing the model on the second subsample of 95 teachers for cross-validation, resulted in a good model fit (χ^2 = 52.161 [df = 45; $p < .215$], CFI = .977, TLI = .966, RMSEA = .041 with a 90% interval of .000 and .083, SRMR = .064). Figure 4 presents the correlation coefficients between the three latent variables together with the factor loadings of the observed variables and the allowed correlations between the specific error terms for both sub-samples 1 and 2.

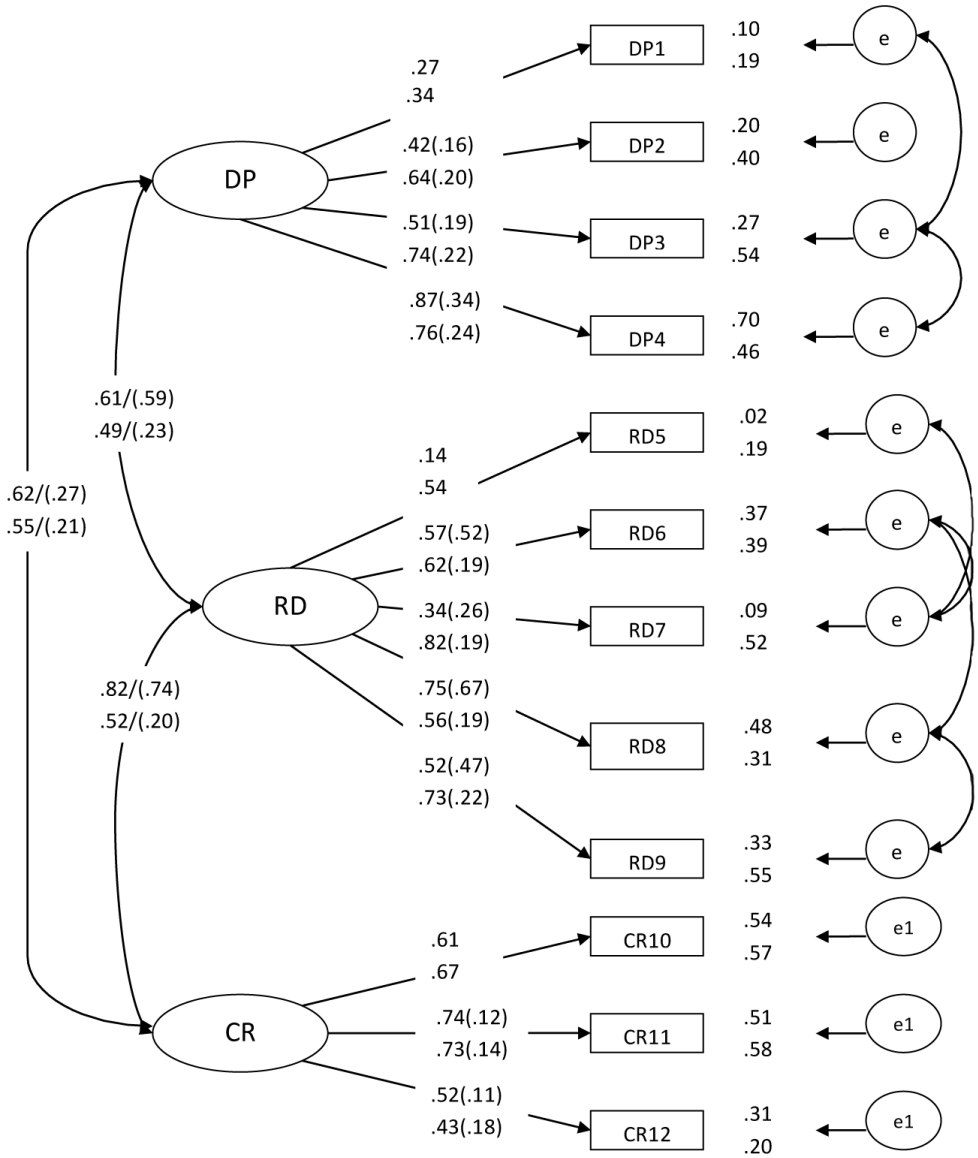


Figure 4. Professional Community Instrument - Model re-specified

Note.

The figure indicates the standardized coefficients and the calculated standardized errors associated with the respective standardized coefficients.

N=102 teachers – first subsample with the coefficients on the first line;

N= 95 teachers - second subsample with the coefficients on the second line

Reliability analysis

Internal consistency is represented by the Cronbach alpha coefficients as shown in Table 3, which indicate a Cronbach alpha coefficient of .81 for the scale of 12 items. The Cronbach alpha coefficients ranged from .77 for the *reflective dialogue* scale or sub-dimension, .68 for the *collective responsibility* scale, and .67 for the *deprivatization of practice* scale.

Conclusion and discussion

The present article has aimed at tackling the complicated problem of developing a tool to measure professional community against the background of a few decades of different uses and interpretations of the concept. Karen Seashore Louis has argued that the measurement of professional community has entered a stage of "cacophony and refocusing": researchers need to refocus on the various approaches to the concept and develop consensus around its measurement (Louis, April 2011). In this context, we have focused on the identification of a valid measurement. We found this tool via a literature search and re-tested it in Dutch educational context, where specific adaptations were made to it, which enabled us to fit the instrument to the specific data.

Professional community as a multidimensional concept

The concept of professional community has proven difficult to define and measure. In other words: it has had a long development process. Its conceptualization started around the 1980s, when issues such as feedback on and cooperation with respect to instructional tasks were associated with collegiality, collaboration and professional communities. At the end of the 1990s, the concept was still measured by using only one sub-dimension, that of sense of community (Bryk & Driscoll, 1988; Newmann, Rutter, & Smith, 1989). After the 1990s, the multidimensional perspective on the concept became dominant, with a focus on concepts such as *deprivatization of practice, reflective dialogue, cooperation, collective responsibility,* and *collective focus on student learning*. After the year 2000, the process redefined by a focus on the facilitating conditions of developing and sustaining an effective professional learning community, such as leadership and collective learning (Bolam et al., 2005).
The main issue in defining and measuring the professional community concept has appeared to be its multidimensional nature. After finalizing a comprehensive meta-analysis, Lomos, Hofman, & Bosker (2001a) concluded that "there are some indications that the different components of the concept of professional community as distinguished theoretically can indeed be measured as separate variables or that these variables can be integrated into one factor" (p.17). Therefore, the instrument selected to be validated in the Dutch educational context, the *Teacher's Professional Community* index (Wahlstrom & Louis, 2008), has

followed the multidimensional criterion.

The most frequently used multidimensional definition concentrates on the sub-dimensions: *deprivatization of practice*, *reflective dialogue, cooperative practices, collective responsibility,* and *focus on student learning* (Kruse, Louis, & Bryk, 1995 in Lomos, Hofman, & Bosker, 2011a). Concerning these sub-dimensions, specific adaptations were necessary to the *Teacher's Professional Community* index (Wahlstrom & Louis, 2008), resulting in a final instrument to be validated containing 15 items and 4 scales or sub-dimensions, namely *deprivatization of practice, reflective dialogue, collective responsibility,* and *focus on student learning*.

Validating the multidimensional model

First, given the expected model modifications, the sample was divided into two stratified subsamples of 102 and 95 teachers in order to facilitate the cross-validation of the model obtained. When testing this *one-component and a four-factor structure model* on the first subsample of 102 teachers, no satisfactory model fit was found. The model results indicated that the scale *focus on student learning* had no relationship with the other three scales and did not belong to the underlying professional community construct. Then, after allowing a few error terms of items within the scales to correlate, the one-component three-factor structure showed an adequate data fit. The final model was tested on the second subsample of 95 teachers, which also resulted in a good model fit. In conclusion, based on the general fit indexes level the one-component three-factor structure of professional community indicated a satisfactory to good model fit with respect to both stratified subsamples (Schreiber et al., 2006).

With these results, our study has validated the multidimensional concept of professional community by extending it to a different educational context. Moreover, our study has offered empirical support for the multidimensionality of the concept and its latent constructs, including *deprivatized practice, reflective dialogue* and *collective responsibility*, by revealing the psychometric properties and construct validity of the instrument in the Dutch educational setting. The satisfactory model fit found for the one-component three-factor structure, including deprivatized practice, reflective dialogue and collective responsibility, provides a strong argument for grouping these specific characteristics into the underlying professional community construct. By opting for a multidimensional operationalization of the professional community concept, the risk of limiting this elaborated phenomenon is reduced (Beck, 1999).

As regards internal consistency, the results of the Reliability Analysis showed a Cronbach alpha value of .81 for the 12 items and a satisfactory to good reliability for the three scales.

Limitations and future research

The first limitation of this study refers to the specific adaptations to *Teacher's Professional Community* index (Wahlstrom & Louis, 2008). First, since *shared norms* was not a common scale in earlier models and its items overlapped with those of *reflective dialogue* and *focus on student learning*, it was excluded from the instrument. Second, although the *Teacher's Professional Community* index (Wahlstrom & Louis, 2008) was constructed on a comprehensive theoretical and empirical basis, it did not contain a *focus on student learning* scale. For our study, we again included this scale, but it was measured using a somewhat different format than used for the other three scales. These relatively different format characteristics might have determined the result of the model fit, which indicated that this scale does not belong to the underlying professional community construct. This issue requires further discussion in view of the implications for future research. In school effectiveness research, "pressure to achieve" has proven to be an important predictor, where meta-analyses have shown effect sizes of .27 (Scheerens & Bosker, 1997, in Marzano, 2000). *Focus on student learning* seems to be a factor of more general importance, which should certainly be given a role in the education research. However, the question could be raised whether focus on student learning should belong to the multidimensional concept of professional community or to the more general domain of school effectiveness. Still, the work of teachers within professional communities and the specific content of their collaboration are issues ultimately focused on student learning, student success or failure, and the means of improving the educational practices. This implies that professional community may be implicitly directed at student learning without explicitly measuring this aspect via items that are positively assessed by the majority of the teachers anyway, as seen in Table 3.

A second limitation concerns the relatively low Cronbach alpha value obtained of the *deprivatization of practice* scale, namely .67. Furthermore, this scale has shown low Cronbach alpha values in other studies as well, such as Louis, Marks, and Kruse (1995) and Bryk, Camburn, and Louis (1999). Additionally, *deprivatization of practice* is considered an important facilitator of successful improvement programs (Reynolds, 2005) and a platform for feedback (Hattie, 2009) and teacher professionalization (Hofman & Dijkstra, 2010). Interestingly however, most studies have reported hardly any or none at all of these activities within schools (e.g. Witziers, 1992; Langer, 2000; Lomos, Hofman, & Bosker, 2011b), which implies that more attention should be paid to the deprivatized practice scale in future studies. One way of doing this would be to investigate more in-depth what teachers understand by deprivatization of practice and what the conditions are that foster or diminish this practice within schools. In addition, the perceived experience and quality of the individual teacher's work could shift teachers' interpretation of deprivatization of practice from working together to solve problems regarding the issue of student learning toward a more advice-oriented approach on individual teaching practices.

In conclusion, future research may continue the validation process of the various measurement instruments, including our model, in different educational contexts (Hofman, Hofman, Gray, & Daly, 2004), especially in less developed African or Asian countries where the professional community concept could make a significant contribution to improving learning outcomes. Moreover, validating the concept in different educational contexts would create opportunities of evaluating the effectiveness and the impact of professional community from a broad international perspective.

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Appendix 1.

Table 2. The items of the Focus on student learning scale

Focus on student learning items Hendriks and Bosker (2003) study	Focus on student learning items Previous studies
The focus of our education is on the cognitive development and learning	The importance to your teaching as a goal for your students is higher level skills (reasoning, problem solving, critical, and creative thinking) (Louis, Marks, & Kruse, 1995)
Our school policy sets high standards for academic performance	This school sets high standards for academic performance (Bryk, Camburn, & Louis, 1995; Smylie, Wenzel, et al., 2003)
In our school we focus first on students' learning	This school focuses on what's best for student learning when making decisions (Bryk, Camburn, & Louis, 1995; Louis, Marks, & Kruse, 1995; Smylie, Wenzel, et al., 2003)

Table 3. Professional community instrument (one scale, 12 items, α = .81; 3 sub-dimensions; *N*=197 teachers)

Items by Subscales	Measurement	Mean	Median	Skewness(se)	Kurtosis(se)	Alpha values	Alpha if item deleted
Deprivatization of practice						.67	
1. How often in this school year have you invited someone in to help teach your class(es)?	Never	1.50	1.00	1.50 (.17)	1.27 (.34)		.61
2. How often in this school year have you had colleagues observe your classroom?	Very rarely	1.93	2.00	.67 (.17)	- .53 (.34)		.55
	Rarely	2.59	3.00	.05 (.17)	- .36 (.34)		.59
3. How often in this school year have you received meaningful feedback on your performance from colleagues?	Occasionally	2.06	2.00	.67 (.17)	- .43 (.34)		.63
4. How often in this school year have you visited other teachers' classrooms to observe instruction?	Frequently						
Reflective Dialogue						.77	
5. How often in this school year have you exchanged suggestions for curriculum materials with colleagues?	Never	3.27	3.00	- .51 (.17)	- .50 (.34)		.77
6. How often in this school year have you had conversations with colleagues about the goals of this school?	Very rarely	3.26	3.00	- .30 (.17)	- .04 (.34)		.73
7. How often in this school year have you had conversations with colleagues about development of new curriculum?	Rarely	3.16	3.00	- .34 (.17)	- .56 (.34)		.71
8. How often in this school year have you had conversations with colleagues about managing classroom behavior?	Occasionally	3.16	3.00	- .37 (.17)	- .39 (.34)		.73
9. How often in this school year have you had conversations with colleagues about what helps students learn best?	Frequently	3.4	3.50	- .32 (.17)	- .27 (.34)		.70

Table 3. Professional community instrument (one scale, 12 items, α = .81; 3 sub-dimensions; *N*=197 teachers) (continued)

Collective responsibility						.68	
10. How many teachers in this school feel responsible to help each other improve their instruction?	Never Very rarely	3.12	3.00	- .09 (.17)	- .05 (.34)		.57
11. How many teachers in this school take responsibility for improving the school outside their own class?	Rarely Occasionally	3.19	3.00	- .27 (.17)	- .35 (.34)		.46
12. How many teachers in this school help maintain discipline in the entire school, not just their classroom	Frequently	3.57	4.00	- .64 (.17)	.28 (.34)		.71
Focus on Student Learning	Strongly disagree					.69	
13. The focus of our education is on the cognitive development and learning	Slightly disagree	3.01	3.00	- .68 (.17)	.46 (.34)		.57
14. Our school policy sets high standards for academic performance	Slightly agree	2.94	3.00	- .67 (.17)	.55 (.34)		.60
15. In our school we focus first on students' learning	Strongly agree	3.01	3.00	- .27 (.17)	- .17 (.34)		.62

CHAPTER 5.

School-based professional communities in secondary schools and student achievement

School-based professional communities in secondary schools and student achievement[1]

Abstract

Given the departmentalized character of secondary schools, it has proven difficult in this educational sector to establish and sustain a school-based professional community (Talbert & McLaughlin, 2002). However, previous empirical studies (e.g. Bryk, Camburn, & Louis, 1999; Little, 1993; Newmann & Wehlage, 1995) have indicated that a school-wide professional community promotes successful school reform and student achievement. Therefore, the present study has investigated the frequency of professional community practices in Dutch secondary schools and their relationship with student performance. Considering the track-based character of Dutch secondary schools (Scheerens, Luyten, & van Ravens, 2011), we explored the relationship between professional community and student achievement both among schools and among educational tracks (vocational and more academically focused tracks). The school-aggregated sub-dimensions and the professional community scale used in our multilevel analysis, based on a sample of 41 schools and 7,293 students, registered no or only a weak relationship with student achievement. Furthermore, only in the more academically focused tracks (VWO) did we observe a few significant effects.

Considering the difference in the effects found among the educational tracks in terms of the aggregated sub-dimensions and the professional community scale, we suggest follow-up studies to contain samples of at least 30 teachers per school in order to obtain good reliability indices and consider the specific differences between educational tracks.

Keywords: school-based professional community; student achievement; secondary schools; educational tracks; types of professional community schools

1 Based on Lomos, C., Hofman, R. H., & Bosker, R. J. (under review). School-based professional communities in secondary schools and student achievement. *Submitted.*

Introduction

The work of teachers in secondary schools is mainly organized within departments, which means that most of their professional community practices are based on the subjects they teach (Grossman & Stodolsky, 1994; Lomos, Hofman, & Bosker, 2011b; Siskin, 1994; Talbert & McLaughlin, 1994). Among these departments there are differences in the strength and coherence of the professional community practices in as far as these are focused on student learning (Little, 2002). Teachers working together across subject boundaries within school-based professional communities have proven to be essential for whole-school reforms (Bryk, Camburn, & Louis, 1999; Little, 1993) by promoting teacher commitment and educational development (Newmann & Wehlage, 1995). In addition, school-based professional communities promote an organizational structure and culture, which stimulates the interaction among teachers and enhances the development of shared norms with respect to student learning (Fullan, 2007; Newmann & Wehlage, 1995).

Given the specific organization of secondary schools into departments and the promising contribution of school-based professional communities, we have recognized the importance of investigating whether the school-based professional community approach is one applicable for secondary schools and to what degree it is related to student achievement.

School-based professional communities in secondary schools and student achievement

Professional community is defined on the basis of five interconnected concepts (Toole & Louis, 2002): *reflective dialogue, collaborative activity, deprivatization of practice, a shared sense of purpose* and *focus on student learning* (Lomos, Hofman, & Bosker, 2011a). However, when referring specifically to school-based professional communities, authors like Bryk, Camburn, and Louis (1999) list three main teacher practices, namely *reflective dialogue*, *deprivatization of practice*, and *peer collaboration*. The *focus on the student learning* sub-dimension of the professional community concept underpins these specific practices, a conclusion also reached by Lomos, Hofman, and Bosker (submitted). In that study, conducted on secondary schools in the Netherlands, we identified *reflective dialogue, deprivatization of practice* and *collective responsibility* as the concept's main components. Moreover, current empirical research makes a distinction between school- and department-based professional communities in secondary schools (Lomos, Hofman, & Bosker, 2011a; Thompson, Gregg, & Niska, 2004). The school-based or school-wide teacher professional community (Louis & Marks, 1998; Newmann & Wehlage, 1995) has proven difficult to develop and sustain in secondary schools as it requires time with respect to culture building (Lee, Louis, & Anderson, under review) and the development of dialogue facilities for teachers. Organizational

arrangements such as these require a structure of social and physical resources, such as a more clustered location of the departments. If the departments are dispersed, for instance in larger schools, teachers may become more easily be isolated (Witziers, 1992), which could impede their communication.

According to the results of a meta-analysis conducted by Lomos, Hofman, and Bosker (2011a), professional community has a small, but significant positive relationship with students' achievement in secondary schools. Moreover, professional communities may not only have an immediate short-term effect on how schools perform in terms of student success, but also a long-term effect on sustainable reforms (Little & McLaughlin, 1993) with lasting effects on school organization and culture (Borman & Fermanich, 2004) and subsequent student achievement levels (Newmann & Wehlage, 1995).

Research problem

Despite the research finding that a "community across a school faculty is rare in American secondary education, given the prevalence of large comprehensive high schools and teachers' strong disciplines identities (…)" (Talbert & McLaughlin, 2002, p.337), we have recognized the relevance of investigating whether or not secondary schools in the Netherlands function as professional communities. In this respect we argue that the teachers' capacities to ensure students' academic achievement need to be enhanced by an ethos of collective responsibility for all students. This approach is meant to raze department boundaries and is given shape by school-wide communication and reflection.

Concerning the research in Dutch schools and their professional community practices, the Dutch primary schools studies have particularly concentrated on school-based professional communities (Verbiest, 2011), while the focus in secondary schools has been mainly on the different subject departments (e.g. Kuhlemeier & Bergh, 2000; Visscher & Witziers, 2004; Lomos, Hofman, & Bosker, 2011b). In a more recent Dutch study, Lomos, Hofman and Bosker (submitted) have proposed to measure school-based professional community by including three latent sub-dimensions, namely *reflective dialogue*, *deprivatization of practice,* and *collective responsibility,* of the overarching concept of professional community. In view of the multidimensional character of the concept, using these three sub-dimensions as separate subscales next to the total scale, enabled us to gain a better understanding of the overarching effect of professional community, an aspect as yet not investigated in great detail by previous studies (Louis & Marks, 1998).

The Dutch secondary education system is divided into several curriculum tracks (Meelissen, 2007). The most important distinction is between vocational tracks (VMBO) and more academically focused tracks (HAVO/VWO). The students are selected to a specific track based

on their scholarly results at the end of primary education (Luyten, 1994), the VWO track being characterized as the most prestigious one. More specific, "VMBO – pre-vocational education" (4 years), includes students between the ages of 12 and 16, "HAVO – senior general education" (5 years), accommodates students aged 12-17 years, and "VWO – pre-university education" (6 years), prepares students aged 12-18 years for an academic study (Eurydice, 2010). The VMBO tracks consist also of several subtracts, namely "VMBO-BB - basic professional-oriented" with an emphasis on vocational and practical training, "VMBO-KB – middle management-oriented" which is composed of an equal amount of theoretical and vocational training, and "VMBO-GL-TL – mixed and theoretical learning" which has the largest share of theoretical education. In addition, within the VMBO-BB educational track students with educational and behavioral problems may also be included as part of the "LWOO – supportive education" arrangement.

If in the past most secondary schools were single-track schools (Luyten, 1994), nowadays most schools offer two (VMBO/HAVO or HAVO/VWO) or all three (VMBO/HAVO/VWO) tracks. There are specific differences between the educational tracks in teachers' level of initial training (Meelissen, 2007), in the balance between vocational and theoretical student training (Eurydice, 2010), and even in the rate of student dropout (Luyten, Bosker, Dekker, & Derks, 2010). Consequently, within the various tracks differences are expected in the frequency of professional community practices and also, depending on the number and types of tracks a school offers, these practices may differ considerably across schools.

In this context, we aimed at investigating whether school-wide professional community is present in Dutch secondary schools (first question) and whether schools can be classified into categories based on the intensity and frequency of *reflective dialogue*, *deprivatization of practice*, and *collective responsability* (second question). Our third question is on the relationship between school-based professional community and student achievement. The hypothesis is that there is a significant positive relationship between school-based professional community and student achievement in secondary schools. Given the stated differences between the various educational tracks, the fourth research question is whether the effect of professional community practices differs between these educational tracks.
In summary, our study has investigated the strength of school-based professional community in Dutch secondary schools in terms of its specific sub-dimensions, and also its relationship with student achievement both across and within the various educational tracks schools offer.

Methodology

Given our focus on school-based communities, we investigated samples of several teachers per school. Next, the school principal provided information on specific school characteristics.

We obtained the information from the teachers and the principal by means of on-line questionnaires. In addition, for each student in the sample, student achievement data and general student background information were available from a national database.

Sample

The school and teacher data was collected as part of a larger evaluation of a new Dutch legislation (i.e. the innovation of the first and secondary stage of secondary schooling) in the school year 2008-2009. A group of 41 secondary schools participated in our study, which is a representative sample in terms of type of secondary school, number of students per school, denomination, and educational vision (Spijkerboer, Hofman, Doolaard, & van der Werf, 2009).

Out of the 341 teachers involved in the study, 157 completed the professional community section of the questionnaire (the focus of our study), with a range of 1 to 8 teachers per school. These 157 teachers taught mathematics (29%), Dutch language (26%), English language (20%) and/or other subjects (e.g. science, informatics, and professional knowledge courses). Most of them taught in lower secondary education (70%), while some worked in upper secondary education of VMBO (26%), and HAVO/VWO (39%). For the 41 schools involved in our study we used achievement and background data for the students who did their final examination at the end of the school year 2009. After matching the school, teacher, and student data, our final sample contained 41 schools, 157 teachers, and 7,293 students.

Variables

Student achievement. The dependent variable used in addressing the third and fourth research questions was represented by the mean scores of the students' national school-leaving examinations taken in 2009 in mathematics, Dutch language, English language and a profession-related subject. These examination scores were obtained per educational track attended by the students:

- VMBO – BB (*N*=853; *M*=6.47; *SD*=.71)
- VMBO – KB (*N*=998; *M*=6.20; *SD*=.66)
- VMBO – GL+TL (*N*=2,178; *M*=6.39; *SD*=.67)
- HAVO (*N*=2,003; *M*=6.26; *SD*=.74)
- VWO (*N*=1,261; *M*=6.23; *SD*=.81)

Across all tracks the mean examination score is 6.31 (with *N*=7,293 and *SD*=.73).

Professional community. We used one scale with three subscales for measuring school-based professional community, as presented next:

- *Professional community scale,* represented by 12 items (*M*=2.98; *SD*=.59)
- and the sub-dimensions
- *Deprivatization of practices*, represented by four items (*M*=2.01; *SD*=.68)
- *Reflective dialogue*, represented by five items, (*M*=3.25; *SD*=.74)
- *Collective responsibility*, represented by three items, (*M*=3.29; *SD*=.74)

The 12 items were measured using a 5-point Likert scale, ranging from 'never' to 'frequently'. The scale addressed the teacher's perception of the frequency with which professional community practices took place in their schools. The validity and reliability of the instrument were assessed in a separate study (Lomos, Hofman, & Bosker, submitted) and were considered to be sufficient. More specifically, the first and second-order confirmatory factor analyses conducted in that study, confirmed that the latent variables/sub-dimensions/ subscales *deprivatization of practice* (4 items, α = .67), *reflective dialogue* (5 items, α = .77), and *collective responsibility* (3 items, α = .68), indeed belonged to the overarching concept (total scale) of professional community (12 items, α = .81).

Since the research questions referred to the professional community practices as school-based characteristics, the teachers' scores were aggregated to the school level when investigating its relationship with student achievement (Lee, Louis, & Anderson, under review). The intraclass correlation coefficient was estimated based on the variance between and within schools by using maximum-likelihood procedures (Snijders & Bosker, 1999). Next, we calculated[2] the observed reliability coefficients of the aggregated variables at .44 for the total scale of professional community and around .36 for the three subscales of the concept (i.e. .50 for the *deprivatization of practice* subscale, .29 for the *reflective dialogue* subscale and .29 for the *collective responsibility* subscale), based on an average number of 4 teachers per school. These reliability estimates are relatively low, which indicates that the teachers of the secondary schools studied had different perceptions of the professional community activities conducted at their schools. Would we have had observed all 83 teachers per school (which is the population harmonic mean), with the same estimated intraclass coefficients, the resulting reliability estimates for the aggregated variables would have been .94 for the total scale, .95 for the *deprivatization of practice* subscale, .89 for the *reflective dialogue* subscale and .89 for the *collective responsibility* one. When interpreting the results obtained, we took the low reliability of the aggregated variables into account, and also kept in mind that the variables referred to schools rather than to teachers.

2 ICC = $\tau^2/(\tau^2+\sigma^2)$, where τ^2 is the variance between schools and σ^2 is the variance within schools, estimated using maximum-likelihood procedures; and the reliability of an aggregate λ_j is $\tau^2/(\tau^2+\sigma^2/n_j)$, where n_j reflects the group sizes in the population (Snijders & Bosker, 1999, p.17, p.26).

School-related variables. 18 schools were *pre-vocational education schools* (only VMBO tracks) and 23 schools *more academically focused schools* (VMBO/HAVO/VWO tracks), as presented in Table 1.

Table 1. Type of school

Type of school	Number of schools	Percentage
VMBO	18	44%
VMBO/ HAVO	2	5%
VMBO/ HAVO/ VWO	17	41%
HAVO/ VWO	4	10%

N=41 schools

Student-related variables. The following student covariates were used in relation to student achievement, namely:

- *gender* (52% female)
- *age* (*M*=16.01; *SD*=.94)
- *socio-economic status* (11% living in disadvantaged neighborhoods; 89% otherwise)
- *ethnicity* (1% western immigrant first-generation; 4% western immigrant second-generation; 3% non-western immigrant first-generation; 10% non-western immigrant second-generation; 82% otherwise)
- *educational track* followed within the secondary schools – Table 2 shows the number of students who followed these types of educational tracks and took the specific final examination.
- *special educational needs provision/LWOO* (11% of the students were placed in special educational needs provision; 89% not)

Table 2. Type of educational track

Type of exam taken	Number of students
VMBO- BB (+lwoo)	853
VMBO-KB	998
VMBO-GL+TL	2,178
HAVO	2,003
VWO	1,261

N=7,293 students

Data analysis

In order to answer the question whether schools could be grouped into categories based on the scores for the three sub-dimensions of the professional community concept, we used hierarchical clustering, with Ward's method (Wishart, 1987). In selecting the number of most relevant clusters, we applied three criteria: 1) they had to have a substantial interval increase in the squared fusion coefficients, 2) they had to contain a sufficient number of units and 3) they had to be suitable for generalization purposes (Hofman, Hofman, & Guldemond, 2001). We used the *z*-scores of the school-aggregated variables for the three professional community sub-dimensions to make sure that the variables could contribute equally to the clustering process.

Considering the two-level character of the data (students nested within schools), we used hierarchical linear modeling (HLM) to test whether professional community had a significant and positive relationship with student achievement both across and within the different educational tracks within secondary schools, while controlling for the student and school covariates indicated previously.

Since the percentage of missing values was less than 1 for both the teacher and the student background data, listwise deletion was employed. Furthermore, as a result of the relatively small school sample size, the significance level was set at .10 for the main effects in order to obtain sufficient power for the statistical tests to be employed.

Results

Secondary schools as professional communities

Our first research question referred to the frequency of professional community practices at secondary schools. A first step was to investigate the individual teachers' perception regarding the frequency of these activities at their schools. Based on the results of the frequency analysis presented in Table 3, it is interesting to report that according to the teachers' perceptions, *reflective dialogue* and *collective responsibility* practices took place only "rarely", while *deprivatization of practice* activities almost "never" occurred. Only the items "exchanging suggestions for curriculum materials", "discussing what helps students learn best" and "maintaining discipline in the entire school" were perceived by the teachers as "occasional" rather than "rare" activities.

Table 3. The Professional Community items and their Frequency (*N* = 157 teachers)

Items by Subscales	Never	Very rarely	Rarely	Occasionally	Frequently
Deprivatization of practice					
1. How often in this school year, have you invited someone in to help teach your class (es)?	68%	18%	11%	3%	0%
2. How often in this school year, have you had colleagues observe your classroom?	43%	31%	19%	6%	1%
3. How often in this school year, have you received meaningful feedback on your performance from colleagues?	17%	28%	43%	11%	1%
4. How often in this school year, have you visited other teachers' classrooms to observe instruction?	43%	21%	26%	7%	3%
Reflective Dialogue					
5. How often in this school year, have you exchanged suggestions for curriculum materials with colleagues?	14%	10%	31%	36%	9%
6. How often in this school year, have you had conversations with colleagues about the goals of this school?	6%	13%	42%	30%	9%
7. How often in this school year, have you had conversations with colleagues about development of new curriculum?	13%	15%	31%	31%	10%
8. How often in this school year, have you had conversations with colleagues about managing classroom behavior?	10%	16%	36%	32%	6%
9. How often in this school year, have you had conversations with colleagues about what helps students learn best?	2%	17%	33%	38%	10%
Collective responsibility					
10. How many teachers in this school feel responsible to help each other improve their instruction?	2%	20%	45%	29%	4%
11. How many teachers in this school take responsibility for improving the school outside their own class?	6%	21%	32%	35%	6%
12. How many teachers in this school help maintain discipline in the entire school, not just their classroom?	3%	12%	27%	43%	15%

To continue, considering that the research questions referred to the professional community practices as school-based characteristics, the scales were aggregated at school level. Table 4 presents the average scores for these practices, as a general representation of the 41 secondary schools in the sample. The mean scores for *reflective dialogue* and *collective responsibility* of 3.24 (.48) and 3.25 (.58) respectively, indicate on average a moderate use of these specific practices within the schools. In addition, *deprivatization of practice* appears to occur on a very low level.

Table 4. Mean scores for the Professional Community sub-dimensions as school characteristics

Sub-dimensions of Professional community	Mean (SD)
Deprivatization of practice	2.05 (.51)
Reflective dialogue	3.24 (.48)
Collective responsibility	3.25 (.58)

N = 41 schools; 5-point Likert scales

In order to answer the second research question, the cluster analysis was carried out on all three professional community aggregated sub-dimensions presented in Table 4, resulting in three empirically-based types of professional community schools, as indicated in Table 5. The results are presented by listing the standardized mean scores together with the descriptive signs – and +. Moreover, the raw means and standard deviations are also presented in order to facilitate an appropriate interpretation of the results.

Table 5. Standardized mean scores and standard deviations; raw mean scores and standard deviations

Professional Community	Cluster 1 (n=12) 29%	Cluster 2 (n=18) 44%	Cluster 3 (n=11) 27%
Deprivatization of practice	-.57 (.47) 1.76 (.24)	-.43 (.42) 1.83 (.21)	1.33 (.88)** 2.73 (.45)
	-	-	+ +
Reflective dialogue	-1.18 (.77)** 2.68 (.37)	.52 (.61) 4.36 (.29)	.44 (.58) 3.45 (.28)
	- -	+	+
Collaborative responsibility	- .40 (.85) 3.02 (.49)	- .11 (1.15) 3.19 (.66)	.62 (.57)* 3.61 (.33)
	-	-	+ +
Names Clusters	Non Professional Community (Non PC)	Reflective Dialogue (RD)	Professional Community (PC)

Note. *N*=41 schools;
The standardized mean scores between .00 and .50 were assigned a (+); those higher than .50 a (+ +); those between .00 and -.50 a (-); and those lower than -.50 a (- -), taking into consideration the significance of the differences. **p < .05; **p < .01 (two-tailed);*

Cluster 1 was named *Non-Professional Community* schools *(Non PC),* referring to 29% of the schools (12 of the 41) whose teachers reported the lowest raw mean scores for the professional community practices. In the second cluster of 18 schools (44%), the teachers mentioned *reflective dialogue* as a predominant community practice. Therefore, this cluster was named *Reflective Dialogue* schools *(RD),* which means that teachers mainly share their opinions on issues such as the goals of the school, curriculum development and classroom management. Finally, we labeled the third cluster *Professional Community* schools *(PC)*. The teachers of the 11 schools (27%) in this cluster reported that all three practices were relevant in their organization when compared to the others, considering that the highest raw mean scores were found. Particularly *collective responsibility* and *deprivatization of practice* were mentioned with a higher frequency, which indicated that the teachers of these schools shared a sense of responsibility for matters like discipline and school level instruction approaches, as well as observing one another's teaching practices and providing feedback. However, even at the 11 *Professional Community (PC)* schools, the mean scores only reflected a moderate frequency of these specific practices.

School-based professional community and student achievement

The third and fourth research questions focused on investigating the relationship between professional community and student achievement within Dutch secondary schools. To

present a more comprehensive picture of the potential predictors of student achievement in secondary schools, next to the professional community indicators, the models in Table 6 include both the significant and the non-significant coefficients.

In the empty model (Model 1) it can be seen that 95% of the variance in student achievement occurs at student level. In Model 2 the student covariates are introduced, which leads to a better model fit, and the explained variance amounts to 5%. The significant effects indicate that female students achieve lower than male students on the final school-leaving national exams, older students achieve lower than younger students, and first and second generation non-western ethnic immigrants achieve lower than Dutch students. Regarding the type of educational track followed, only the final examination scores of VMBO-BB students are significantly different from those of VWO students (baseline). And finally, students with "special education needs provision" (LWOO) have lower scores than regular students. From the results under Model 3 it can be derived that there is no significant difference in achievement between students from the more academically focused schools (VMBO/HAVO/VWO) and those from the pre-vocational schools (VMBO) in the 41 schools investigated.

Table 6. Professional Community and student achievement

Models	1 Empty	2 Student	3 School	4 PC Scale	5 PC sub-dimensions	6 PC Clusters
Fixed effects						
Intercept	.03 (.04)	.17 (.05)**	.10 (.08)	.17 (.06)**	.17 (05)**	.18 (08)**
Gender/Female		-.18 (.02)***	-.18 (.02)***	-.18 (.02)***	.18 (.02)***	-.18 (.02)***
Age		-.13 (.02)***	-.13 (.02)***	-.13 (.02)***	-.13 (.02)***	-.13 (.02)***
SES		-.01 (.04)	-.01 (.04)	-.01 (.04)	-.00 (.04)	-.01 (.04)
Ethnicity with Baseline Dutch						
Western 1st		-.13 (.10)	-.13 (.10)	-.13 (.10)	-.13 (.10)	-.13 (.10)
Western 2nd		-.04 (.06)	-.04 (.06)	-.04 (.06)	-.04 (.06)	-.04 (.06)
Non-western 1st		-.33 (.07)***	-.33 (.07)***	-.33 (.07)***	-.33 (.07)***	-.33 (.07)***
Non-western 2nd		-.27 (.04)***	-.27 (.04)***	-.27 (.04)***	-.27 (.04)***	-.28 (.04)***
Educational track with Baseline VWO						
VMBO-BB(+lwoo)		.50 (.07)***	.51 (.07)***	.51 (.07)***	.52 (.10)***	.51 (.07)***
VMBO-KB		-.05 (.06)	-.04 (.06)	-.04 (.06)	-.04 (.10)	-.04 (.06)
VMBO-GL+TL		-.04 (.05)	-.03 (.05)	-.03 (.05)	-.03 (.06)	-.03 (.05)
HAVO		-.06 (.04)	-.06 (.04)	-.06 (.04)	-.06 (.05)	-.06 (.04)
Special needs education		-.39 (.05)***	39 (.05)***	-.39 (.05)***	-.39 (.05)***	-.39 (.05)***
School type with Baseline VMBO						
VMBO/HAVO/VWO			.11 (.08)	.11 (.08)	.15 (.08)	.09 (.09)

Table 6. Professional Community and student achievement (continued)

PC Scale				-.03 (.04)		
Deprivatization of practice					.05 (.05)	
Reflective dialogue					.01 (.04)	
Collective responsibility					-.11 (.04)**	
Clusters' effect with Baseline Cluster 1 Non-PC						
Cluster 2 Reflective Dialogue						.02 (.09)
Cluster 3 Professional Community						-.05 (.11)
Variance Components						
School variance	.058 (.24)	.055 (.23)	.054 (.23)	.055 (.23)	.050 (.22)	.056 (.24)
Student variance	.951 (.97)	.903 (.95)	.903 (.95)	.903 (.95)	.903 (.95)	.903 (.95)
Decrease in deviance		331.63***	.44	-5.96*	-8.83*	-5.27
Unique explained variance		5%				

Notes. N student level= 7,293; N school level= 41; Fixed coefficients are followed by their standard errors;
**p < .10; **p < .05; *** p < .001*; (two-tailed).

In Models 4, 5, and 6 we present the effects of the various measurements of professional community used: the total scale, the three sub-dimensions and the clusters respectively. The three models indicate that only in the case of one sub-dimension a significant relationship with student achievement can be observed. From the results under Model 4 it can be seen that including professional community as an overarching concept to predict student achievement does not result in a significant coefficient. From the results under Model 5 it can be seen that the sub-dimension *collective responsibility* has a negative significant association with student achievement scores. This result contradicts our hypothesis that professional community has a positive relationship with student achievement in secondary schools. Moreover, *collective responsibility* is the only sub-dimension with a significant relationship with student achievement, albeit negative. Regarding Model 6, both the cluster of *Reflective Dialogue* schools and *Professional Community* schools do not have significantly higher student achievement levels as compared to the *Non-Professional Community* schools.

Professional community and distinct educational tracks

The next section presents the relationship between the professional community measurements and student achievement separately for the educational tracks. These results regard the fourth research question of the present study.

The same steps or Models as presented in Table 7 were used for each separate track, thereby excluding the student covariates that indicate the type of track followed. We refrain from presenting the effects of the covariates and focus on the theoretically interesting effects only. In Models 3, 4, and 5 (see Table 7), we show for each separate educational track the relationships of the total professional community scale, the three sub-dimensions, respectively and the school clusters with student achievement. Table 7 presents the coefficients and the decrease in deviance determined by each specific predictor or group of predictors, indicating in general for none of the educational track types a significant improvement in model fit. However, if the relationship is considered one-tailed, following the initial hypothesis of a positive relationship, some coefficients appear to be significant.

Table 7. Professional Community effects in different educational tracks

Educational track	VMBO-BB	VMBO-KB	VMBO-GL+TL	HAVO	VWO
			Standardized coefficients		
Model 3/PC scale	.01 (.06)	-.01 (.06)	-.10 (.04)**	-.04 (.08)	.10 (.07)*
Decrease in deviance	- .01	- .01	.01	- .01	.18
Model 4/PC sub-dimensions					
Deprivatization of practice	-.03 (.08)	-.01 (.07)	-.01 (.05)	.03 (.12)	.05 (.10)
Reflective dialogue	.08 (.09)	.05 (.09)	.01 (.05)	.01 (.09)	.12 (.06)**
Collective responsibility	-.05 (.07)	-.05 (.07)	-.13 (.06)**	-.10 (.14)	-.06 (.11)
Decrease in deviance	- .02	- .01	.01	-.01	.18
			Non-standardized coefficients		
Model 5 Clusters with Baseline Cluster 1 Non-PC					
Cluster 2 RD Cluster 3 PC	-.01 (.17) -.10 (.18)	-.07 (.17) -.07 (.17)	-.11 (.12) -.21 (.12)*	.22 (.16)* -.12 (.21)	.21 (.14)* .09 (.18)
Decrease in deviance	- .01	- .01	.01	.01	.18

Notes. VMBO-BB *N student level= 853, N school level*= 17; VMBO-KB N *student level*= 998, N *school level*= 17; VMBO-GL+TL N *student level*= 2,178, N *school level*= 34; HAVO N *student level*= 2003, N *school level*= 23; VWO *N student level*= 1,261, *N school level*= 21;
Fixed coefficients are followed by their standard errors;
*$p < .10$; **$p < .05$; *** $p < .001$; (one-tailed)

More in detail, Model 3 – the total professional community scale - displays a one-tailed significant and positive association in the VWO educational tracks, which is the only result in line with our hypothesis. Using the standardized coefficient obtained[3], the calculated effect size is .20, which can be considered a small effect in Cohen's (1989) terms. However, no significant improvement in model fit was observed through this effect. Regarding the other effects, the professional community scale showed an unexpected negative significant relationship with student achievement in VMBO – GL+TL tracks. Turning to the results presented under Model 4 it can be seen that only for the VWO tracks our hypothesis has again been confirmed for the *reflective dialogue* sub-dimension. The effect size, however, is .24 and thus rather small and no significant improvement in model fit was found. Regarding the *deprivatization of practice* sub-dimension, it had no significant relationship with student achievement, irrespective which educational track. And finally, the *collective responsibility* sub-dimension showed a negative significant relationship with student achievement in VMBO – GL+TL. To summarize, the negative effects did not confirm our working hypothesis. Finally, Model 5 confirms our hypothesis in the HAVO and VWO educational tracks, with the *Reflective Dialogue* cluster of schools positively and significantly (one-tailed) related to student achievement. The effect sizes were calculated based on the total explained variance[4], resulting in small effects of .28 in the HAVO and .18 in the VWO tracks. One significant effect did not support our hypothesis, showing a negative association of the *Professional Community* schools with student achievement in VMBO-GL+TL. However, none of these one-sided significant effects determined a significant improvement in model fit. The contrast test showed also no significant difference in effects between the clusters of schools.

Conclusion and discussion

Summary of results

In the present study, we were interested in establishing whether secondary schools in the Netherlands in general work as professional communities. We especially wanted to know if the educational practices related to the concept could be linked to specific educational tracks offered by these schools. The principal topic of our study however, was the relationship between school-based professional communities and student achievement, and in particular the possible differences in this among the educational tracks offered within secondary schools. The various educational tracks can be distinguished in terms of the differences in their content and the difficulty levels of their curricula and national examinations.

3 Effect sizes for standardized coefficients were calculated as twice the coefficient divided by the square root of 1 minus the coefficient raised at power 2 (Borenstein, Hedges, Higgins, & Rothstein, 2009).

4 Effect sizes for non-standardized coefficients were calculated as twice the square root of total variance explained.

In this respect, our study has added to the current body of knowledge by (a) using a different validated instrument to measure the professional community concept, (b) investigating the concept and its sub-dimensions as a school-based rather than as a department-based characteristic, (c) exploring the influence of the professional community concept by particularly considering the effects of its specific sub-dimensions, and (d) examining the effect of professional community not only among secondary schools, but also among the educational tracks offered by these schools.

In this context, through the *first* research question we focused on whether secondary schools function as professional communities. The teachers' individual perceptions generally indicated that professional community practices took place only "rarely" happening, which can be interpreted as a low frequency of these specific activities at the schools. Only a few were perceived as happening "occasionally" or moderately. As school-based characteristics, *reflective dialogue and collective responsibility were reported by the teachers to occur at a low to medium frequency, while deprivatization of practice were claimed to be performed at an even lower rate. These results show that the school-based professional community characteristic is relatively weakly represented by the Dutch secondary schools, with some practices playing a more predominant role than other ones.*

The second research question focused on whether there are any differences in how schools use the professional community *sub-dimensions*, in other words: can schools be categorized on the basis of the frequency with which they perform professional community practices? First, *reflective dialogue* and *collective responsibility* were reported as relevant sub-dimensions at the school level, such as discussions about the curriculum or class management and a shared responsibility for activities outside their own classrooms. This result has also been confirmed by other studies, such as Lee, Louis, and Anderson (under review). When the schools were clustered on the basis of these sub-dimensions, the *reflective dialogue* sub-dimension was found to be an important indicator of professional community in 44% of the schools of the *Reflective Dialogue* (RD) cluster. It is not surprising that *reflective dialogue* is considered as an important professional community practice at the school level, given the importance attached to the discussion of issues such as the school objectives, the curriculum, and student attainment, as part of the school policies. In addition, the *Professional Community* (PC) cluster (27% of the schools) was the group that reported all three sub-dimensions to occur with the highest presence of *deprivatization of practice* and *collective responsibility* within their school, in comparison with the other clusters of schools or the mean score for this sub-dimension. This finding implies that only 11 schools (*PC*) indicated that they performed in relatively moderate frequency the activities associated with all three sub-dimensions of the professional community concept. However, although the mean scores for the professional community sub-dimensions at the 11 schools are the highest ones reported, these scores are still low, when compared to the maximum values possible. This means that even at the

most representative schools there is only a modest frequency of professional community practices.

In the *third* and principal research question we dealt with the relationship between professional community and student achievement in secondary schools. After controlling for the main student covariates, we found that the total school-based professional community scale showed no significant relationship with student achievement. On the basis of previous empirical evidence we had expected a significant and positive relationship (Lomos, Hofman, & Bosker, 2011a). Our approach was, however, more detailed in that we investigated the effects of three specific professional community sub-dimensions as a basis for categorizing the schools into different professional community clusters of schools, with no significant effect either. We found that only the *collective responsibility* sub-dimension had a significant but negative relationship with student achievement. A possible explanation for the low to non-significant relationships found could be the low reliability of the aggregated professional community scales and subscales (.44 for the total scale), which may have caused the low predictive validity of the subscales and implicitly determined the weak to non-existing relationship with student achievement.

Considering that the Dutch secondary education is known for its highly tracked character (Hanushek & Woessmann, 2005; Luyten, 1994; Scheerens, Luyten, & van Ravens, 2011), the purpose of our *fourth* research question was testing the role of the school-based professional community in various educational tracks within the secondary schools sampled and its relationship with student achievement. The hypothesis that the professional community concept is positively related to student achievement was mainly confirmed in the VWO educational tracks. Here, the total professional community scale showed a positive and significant relationship with student achievement with an effect size of .20, which is in line with the summary effect size of .25 established in the meta-analysis of Lomos, Hofman, and Bosker (2011a). The VWO track is known as pre-university education, the highest secondary education degree to be obtained and its staff mainly consists of grade one teachers in possession of a Master of Education degree (Eurydice, 2010). However, the effects found did not improve the model fit, while also the significance level was based on a one-sided hypothesis. In addition, the effect of the three professional community sub-dimensions were also investigated, separately, resulting into one positive effect, also in the VWO tracks. The *reflective dialogue* sub-dimension was the only one significantly and positively associated with student achievement, with an effect size of .24. This finding singles out this sub-dimension as a relevant predictor of students' achievement in VWO tracks. *Reflective dialogue* refers to the discussions among teachers about issues such as school goals, classroom behavior, student learning, and curriculum materials. Just as in Dutch schools, this sub-dimension is also highly common in American secondary schools (Lee, Louis, & Anderson, under review). In addition, *reflective dialogue* was the main sub-

dimension represented in the *RD* school cluster. The *RD* cluster of schools proved to be significantly and positively related to student achievement, with a .18 effect size for VWO and an additional effect of .28 for HAVO. It is therefore safe to conclude that the *RD* school cluster is the most positively associated with student achievement in the higher tracks of Dutch secondary education. This cluster of schools registered also a moderate presence of the *collective responsibility* and *deprivatization of practice* sub-dimensions. Regarding the size of the effects found, Hofman (1999) argues that even a small positive school effect can be very relevant, given the number of the pupils that may gain from its benefits.

Still, only in the VWO educational tracks did the total scale and the *reflective dialogue* sub-dimension show a weak positive relationship with student achievement, if the effects were considered one-sided. Moreover, the non-significant decreases in deviance and the low value of the significant coefficients show that the Dutch secondary education school-based professional communities are not strongly associated with student achievement. Furthermore, the commonness of professional community practice is low and even if it is relatively higher in some schools, it has not proven to be strongly related with student achievement.

Limitations and future research directions

Nevertheless, our results need to be interpreted by taking into consideration the main limitation of this research, namely the relatively low number of schools involved in the study: 41 secondary schools. In addition, the number of schools decreased when the educational tracks were taken into account separately, since – for example – HAVO and VWO are in general accommodated in one school. In addition, a low number of teachers participated from each school as well. Subsequently, it is important to point out the low reliability estimates for the aggregated professional community variables, which indicate that the teachers in our sample, 4 on average per school, differed in their perceptions regarding the commonness of professional community practices within their schools. More specifically, the reliability estimates of the aggregated variables were .44 for the total professional community scale and on average .36 for the three subscales, which suggests that with only 4 teachers per school on average, we were not able to find a sufficient degree of generality on the perceived frequency of the professional community practices conducted at the schools. Considering that a reliable aggregated measure could have been obtained at a population harmonic mean of 83 teachers per school (i.e. .94 for the total scale, .95 for the *deprivatization of practice* subscale, .89 for the *reflective dialogue* subscale and .89 for *collective responsibility*), the minimum estimated number of participants required for a reliable measurement of these school-based practices has been determined to be no less than 30 per school (Snijders, & Bosker, 1999). This implies that in order to establish a homogeneous perception of the school-based professional communities within secondary schools, a relatively large sample of teachers is required.

In order to promote a more reliable measurement of the school-based processes within secondary schools, future studies should focus on using larger secondary school and teacher samples. Moreover, such samples could be combined with longitudinal student achievement data. In this way, a broader and more reliable picture of the role of professional community in secondary schools could be obtained as well as an understanding of its long-term impact. Moreover, other recent studies have also shown that secondary schools are not the most facilitating environment for school-based teacher professional communities (Lee, Louis, & Anderson, under review), which could rise for future research an issue focused on investigating the specific conditions of secondary schools that foster or diminish the professional communities' practices. All in all, it can be concluded that a better look needs to be taken at how secondary schools are organized and how the cultures that promote a professional community environment could be supported within the schools and their educational tracks.

CHAPTER 6.

Conclusion

Conclusion

In the past three decades, the concept of professional community has gained momentum in both theory and practice (Nehring & Fitzsimons, 2011). However, its conceptualization still proved to be a problematic issue, while the hypothesis of a positive association with student achievement required more thorough empirical evidence. This is why the present thesis first focused on clarifying the concept in general and reviewing the empirical evidence regarding the hypothesis of a positive relationship between professional community and student achievement in secondary schools. Secondly, next to the process of operationalizing and measuring the concept, its association with student achievement was tested specifically in Dutch secondary schools.

Three main research questions were formulated for this dissertation:

1. How is the concept of professional community defined and operationalized?
2. How can the concept and its sub-dimensions be measured and validated?
3. Is there a relationship between professional community and student achievement in secondary schools?

This next section first presents a summary of the results of the four studies conducted, followed by the answers to the three research questions. Finally, we will offer some suggestions for future research and practice while taking into consideration the specific limitations of these studies.

Summary of the main findings per study

Chapter 1 presented an overview of the temporal development of the professional community concept. Central issues were the processes of defining, operationalizing, and measuring the concept. From the 1980s, when the first study in this area was published (Little, 1982) until today, the development of the concept has covered three specific periods: the *definition* phase (1982-1994), the *operationalization and measurement* phase (1995-2005) and the *implementation and conditions* phase (2005-2009). Based on the constructs of *collegiality* and *collaboration*, professional community took shape after the 1990s as a multidimensional concept, while the term was used interchangeably with the concept of *professional learning community*. We concluded chapter 1 by providing the most common definition of the professional community concept, which proved to be multidimensional in nature (Toole & Louis, 2002).

Chapter 2 was particularly focused on the problems involved in specifying a universal definition of professional community and the operationalization of the concept. To shed more light on these issues we examined both the theoretical and empirical evidence available in the literature. Explanations why professional community was hard to grasp, both conceptually and methodologically, were - for example - the various theoretical perspectives used, the comprehensiveness of the integrated key concepts of *professionalism, learning,* and *community* (Toole & Louis, 2002), and the large number of different terms used in connection with the concept, such as *collegiality*, *teacher collaboration*, *networks*, *communities of practice*, and so on. Around the year 1995, professional community was differentiated from other related concepts and defined and operationalized on the basis of a multidimensional perspective, which includes five interconnected sub-dimensions: *reflective dialogue, deprivatization of practice* or *feedback on instruction, collaborative activity, shared sense of purpose or collective responsibility,* and *focus on student learning*. Next to that, a meta-analysis was conducted to explore the relationship between professional community and student achievement in secondary schools. After a comprehensive review of the literature, the Cohen's *d* effect sizes obtained after separate calculations, ranged from small to medium positive effects (e.g. .22 in Lee & Smith, 1996 to .56 in Louis & Marks, 1998) with a significant summary effect size of .25 for which the 95% confidence interval did not cross the zero line. From these results it could be concluded that the relationship between professional community and student achievement in secondary schools is positive and significant, with a small but relevant effect size.

Considering the organization of secondary schools in departments (McLaughlin & Talbert, 2001; Witziers, 1992), Chapter 3 explored the extent to which the professional community principle was used in a number of mathematics departments and its importance for student achievement. The main results, based on a re-analysis of data from an IEA-TIMSS study of

130 teachers (from 130 schools), showed that mathematics professional communities are relatively well developed. More specifically, 73% of the mathematics teachers indicated that at least one of the five professional community characteristics was more or less specific for their way of working. Especially *shared sense of purpose* and *focus on student learning* were reported as the approaches most commonly adopted, followed by *reflective dialogue*. *Deprivatization of practice* was documented as the least common activity of the teachers within the math departments. Furthermore, only *focus on student learning* was significantly and positively related with the achievement scores of the 2,706 students involved in this study, with a small effect size of .24. When clustering the schools based on the strength and frequency of the five characteristics within the mathematics departments, 40 of them (34%) could be labeled as *Professional Community* schools. This category of schools was associated with the highest student achievement scores in comparison to *Collaborative activity* schools (28%), *Deprivatization of practice* schools (11%) and *Non-Professional Community* schools (27%). Moreover, only the *Professional community* cluster of schools showed a significant and positive relationship with the students' math results (a .20 effect size), thereby singling out Dutch department-based professional community as a potential precursor of student achievement. These results were found to be independent of the type of school, namely *pre-vocational* (VMBO) or the *more academically focused schools* (HAVO/VWO), and were obtained after controlling for student, teacher, and school covariates.

Chapter 4 dealt with the operationalization of the concept and the delimitation of its key sub-dimensions in earlier studies. More than 60 articles and a further selection of eight relevant instruments were analyzed based on a set of specific criteria. The *Teachers' Professional Community* index (15 items, 4 sub-dimensions) of Wahlstrom and Louis (2008, p.487) best met most of the analysis criteria. After some specific adaptations of the Wahlstrom and Louis (2008) instrument, our final tool to be validated in the Dutch context contained four sub-dimensions of professional community: *deprivatization of practice, reflective dialogue, collective responsibility* and *focus on student learning*. However, the empirical results of our first and second-order confirmatory factor analyses, cross-validated on two stratified subsamples of 102 and 95 teachers, provided a strong argument for including only three professional community sub-dimensions and excluding the *focus on student learning* characteristic. This resulted in the *Professional Community instrument* (12 items, 3 sub-dimensions), which was successfully validated in the Dutch educational context.

In Chapter 5 the strength of school-wide professional communities in Dutch secondary schools based on the three selected sub-dimensions and its relationship with student achievement among schools and among educational tracks was studied. Based on the perceptions of 157 teachers from 41 schools, *reflective dialogue* and *collective responsibility* practices were reported to occur at a moderate frequency. As school-based characteristics, these two sub-dimensions were indicated to be practiced at a moderate frequency, which was - however –

a higher rate than that of *deprivatization of practice*. Based on the school-aggregated values of professional community, the schools were clustered into different categories and labeled subsequently as *Professional Community* schools (27%), *Reflective Dialogue* schools (44%) and *Non-Professional Community* schools (29%). The hypothesis of a positive relationship between professional community and student achievement was confirmed only in the VWO educational track and not in the other tracks, namely VMBO and HAVO. In more detail, the total professional community scale had a positive (one-sided) and significant relationship with student achievement in VWO, with a significant effect size of .20. In addition, the *reflective dialogue* sub-dimension (.24 effect size) and the *Reflective Dialogue* schools cluster (.18 effect size) also had a positive (one-sided) significant relationship with student achievement in the VWO educational track. However, in the VMBO-GL+TL track, the relationship between professional community (i.e. the total scale, the *collective responsibility* sub-dimension and the *Professional Community* schools cluster) and student achievement proved to be negative. To conclude, only a few positive significant effects were found, findings that do not promote strong arguments for supporting the hypothesis of positive associations between professional communities and student achievement within Dutch secondary schools.

General discussion, relevance of the studies and their implications

How is the concept of professional community defined and operationalized?

With respect to the first research question, it was established that professional community has a multidimensional character. Although researchers have had difficulty in agreeing on a fixed set of sub-dimensions, as indicated in chapter 2, the concept is generally defined and operationalized on the basis of five characteristics: *reflective dialogue, collaborative activity, deprivatization of practice, shared sense of purpose*, and *focus on student learning*. Moreover, in secondary schools, professional community can be either seen as a multidimensional concept, both on the department-based and on the school-based level.

How could the concept of professional community and its sub-dimensions be measured and validated?

Louis argues that the professional community concept has entered a stage of “cacophony and refocusing”, and that researchers need to refocus on the various approaches to the concept and develop consensus about its measurement (Louis, AERA, 2011). Consequently, the comprehensive review presented in chapter 4 showed that in the past three decades professional community has been measured by means of different instruments, all based on one or more, or all five sub-dimensions. When employing the instrument selected in the Dutch educational system, however, there appeared only to be three relevant sub-dimensions of the professional community concept : *reflective dialogue, deprivatization of*

practice and *collective responsibility*. We can therefore conclude that in order to capture its multidimensional character, professional community has to be measured on the basis of several, rather than just one sub-dimension, which in our research context were the three characteristics in particular.

In addition, our findings have shown that *focus on student learning* does not have to be an explicit separate sub-dimension of the concept but the underlying ultimate goal of professional community. The teachers need to understand *focus on student learning* as an overarching meaning, which determines both the content of their collaborative practices and their focus, in line with the findings of Sigurðardóttir (2010) and Timperley (2008).

Is there a relationship between professional community and student achievement in secondary schools?

The meta-analysis reported in chapter 2 resulted in a summary effect size of .25, a small effect size in Cohen's terms (1989), for the relationship of professional community with student achievement in secondary schools. This positive relationship of professional community with student achievement was only partially confirmed in chapter 5, namely for one of the educational tracks, the VWO track, with an effect size of .20. More specific, the scale of professional community did not proof to be significantly related to student achievement in all educational tracks, indicating even a negative association in VMBO-GL+TL. When investigating the distinct sub-dimensions as school-based characteristics, *reflective dialogue* also appeared to have a positive relationship with student achievement albeit only in the VWO educational tracks, with an equal effect size of .24. Therefore, with respect to the third research question we can conclude that professional community has a weak positive relationship with student achievement. This relationship differs among the educational tracks as well as among the professional community sub-dimensions. In addition, schools characterized by stronger mathematics departments in terms of the frequency of professional community practices, were associated with higher student achievement levels in mathematics, with a clear emphasis on focus on student learning. However, this finding did not pertain to school-based professional communities, where the professional community levels were low. And although these levels were higher in some particular schools, a strong relationship with student achievement could not be established.

Limitations and implications for future research and practice

The limitations of this study and our suggestions for future research and practice were formulated on the basis of our findings in answering the three research questions of this dissertation.

How is the concept of professional community defined and operationalized?

One limitation of this thesis concerns the way in which professional community was defined in our four studies, specifically as a multidimensional concept, which sub-dimensions are integrated in one overarching construct. So in order to fully understand this concept and its implications, both the role of the total scale and that of its separate sub-dimensions had to be investigated. However, the meta-analysis in chapter 2 only investigated the effect of the total scale, which is why here no data was obtained on its separate sub-dimensions. Therefore, the results of the meta-analysis could only be compared with the results in chapter 5, in which professional community was also measured as one scale. More specific, in chapter 3 the concept was only measured on the basis of its five separate characteristics, this is why we could not compare the results with the summary effect size identified in chapter 2.

Continuing with the importance of the professional community sub-dimensions, the results regarding some of the five sub-dimensions have important implications for both future research and practice. Starting with the implications for research, one such sub-dimension is *deprivatization of practice* that showed a low presence in both department- and school-based professional communities, in line with the findings of Langer (2000), Sigurðardóttir (2010) and Witziers (1992). Moreover, this sub-dimension was found to have negative associations with student achievement under all conditions, excluding the HAVO and VWO educational tracks. Still, deprivatization practices are generally considered as important facilitators of – for example - successful improvement programs (Reynolds, 2005), the exchange of knowledge (Vermeulen, 2011) and feedback (Hattie, 2009), or teacher professionalization (Hofman & Dijkstra, 2010). Moreover, in the Netherlands, *deprivatization of practice* is specifically recommended to beginning teachers, a fact which could shift the meaning of this sub-dimension from sharing knowledge to supervision, with implications for the meaning given by teachers to these practices. These findings imply that more studies focused on defining the purpose of these deprivatization practices could be beneficial for Dutch secondary schools.

Continuing with the practical implications, the low occurrence of *deprivatization of practice* in Dutch secondary schools could be a topic to be addressed in teacher training programs. Beginning teachers need to be exposed to such feedback-oriented practices by observing other teachers' classes and providing meaningful feedback on the improvement of student learning. In addition, both beginning and experienced teachers should be trained in providing and receiving feedback on their teaching activities, again with the ultimate aim of improving the learning of their students. Although teacher training institutes in the Netherlands have considered it as essential to prepare teachers for collaborating in professional communities, some authors (e.g. Dobber, 2011; Dobber, Akkerman, Verloop, & Vermunt, 2011) argued

that this issue is only weakly represented in the curricula currently implemented.

How could the concept of professional community and its sub-dimensions be measured and validated?

When validating the instrument of Wahlstrom and Louis (2008) in the Dutch educational context, we made specific theoretically and psychometrically based adaptations and modifications. As a result, these specific adjustments, which were cross-validated on two subsamples, made our final instrument (the *Professional Community instrument*) to be somewhat different from the original instrument (the *Teachers' Professional Community* index), which may limit its applicability in other educational settings.

Considering this limitation, an implication for future research could be that researchers may therefore retest this instrument in their studies to establish whether more adaptations are necessary within their own educational context, a suggestion also done by Stoll and Louis (2007). In addition, the particular context of a country where such an instrument is developed and validated is important, for instance because of the features of its educational system, the size of its (secondary) schools, the position and function of the teachers within schools, and the types of student assessment practices (Hallinger & Kantamara, 2000; Hofman, Hofman, & Gray, 2010). By the use of an international perspective and using similar/identical instruments, professional communities could be compared on a cross-country basis (Thomas, 2011) through future comparative research.

In practice, the use of a valid instrument to measure professional communities and their sub-dimensions will enable teachers and educational actors to obtain a better understanding of the professional community concept. Furthermore, the designated questions will help clarify the nature of the communities' sub-dimensions in a more concrete manner.

Is there a relationship between professional community and student achievement in secondary schools?

With respect to the methodological aspects to be taken into account in future research, there is an empirical need for more multilevel research studies (Reynolds, Sammons, de Fraine, Townsend, & van Damme, 2011), as well as a shift towards quantitative research methods when studying department-based professional. Considering that former studies of department-based communities have mainly employed qualitative techniques (e.g. Berry, Johnson, & Montgomery, 2005; Dalgarno & Colgan, 2007; Evans-Stout, 1998; Siskin, 1991), this thesis study is relevant in that we particularly used quantitative and multilevel research methods. In addition, in exploring whether professional communities are mainly the result of the organization of the school or of the initiatives of people with particular personality traits, new approaches could be used to triangulate the quantitative data, such as network analysis

(Moolenaar, Daly, & Sleegers, 2011). Given that in investigating professional community the group or the user community is the unit of analysis (Sleegers, Bolhuis, & Geijsel, 2005), network analysis would provide a better understanding of the impact of personality traits (Witziers, 1992) and teachers' behavior (Hofman, Dijkstra, & Hofman, 2009; Witziers, 1992) on the spread and strength of professional community practices. In addition, experimental or quasi-experimental designs (Sigurðardóttir, 2005) could be used in testing more efficient forms of deprivatization of practice and feedback training (Gielen, Peeters, Dochy, Onghena, & Struyven, 2009; Thurlings, Vermeulen, Bastiaens, & Stijnen, 2011).

Considering that professional community is not a static but a dynamic concept which is susceptible to change over time, it would be interesting to investigate the development of professional communities during a longer time span, especially in terms of their role in student learning. Specifically in the Netherlands, where changes were implemented in the secondary education sector in 2007 (Eurydice, 2010; Spijkerboer, Hofman, Doolaard, & Van de Werf, 2009), more insight could be gained through longitudinal research into the long-term effects of professional communities on the development of student progress.
Given the empirical evidence that professional communities and their effects differ among educational tracks, follow-up studies into Dutch secondary schools should take into account the possible differences between secondary schools and educational tracks more strongly (Luyten, 1994; Luyten & de Jong, 2006). Subsequently, more research is needed into the background and the impact of, for example, different management styles (Hofman & Hofman, 2011) and teaching qualifications (Eurydice, 2010), on the presence of professional community activities within distinct educational tracks.

The future of indirect effects

As a final topic for future research, we bring up the role of the school's context and its implication for the definition of professional community. The size of the effects found in this thesis indicates a weak positive relationship between professional community and student achievement, characterized by small significant effects. Based on these results and inspired by different comprehensive models of mediated or reciprocal effects proposed and partly investigated by D'Amico et al. (2001), Geijsel, Sleegers, van den Berg, and Kelchtermans (2001), Newmann, King, and Youngs (2000), and Talbert, (1991), we question the direct link between professional community and student achievement. In addition, we propose an integration of different mediating or moderating variables, such as teacher and school characteristics that can influence or condition the relationship between professional community and student achievement (ten Bruggencate, 2009; Krüger, Witziers, & Sleegers, 2007; Willey, 2001). The reviews of Cormier and Olivier (2009) and Little (2006) indicated relevant factors such as leadership (Geijsel, Sleegers, Stoel, & Krüger, 2009) and school reform (Camburn, Rowan, & Taylor, 2003), trust (Wahlstrom & Louis, 2008), teacher learning

and experimentation (Bryk, Camburn, & Louis, 1999), teacher commitment (Hausman & Goldring, 2001; Rosenholtz & Simpson, 1990), professionalism (Talbert & McLaughlin, 1994), collective efficacy (Goddard & Goddard, 2001), and teacher efficacy (Newmann, Rutter, & Smith,1989) as important teacher or school characteristics which condition the development of professional communities. Most recently, the study of Louis, Dretzke, and Wahlstrom (2010) used path analysis to investigate such conditioning effects of trust, type of school, and shared and instructional leadership on student achievement, all mediated by the effect of professional community. Interestingly, the effect of professional community on student achievement was significant but indirect in that it was also mediated by the effect of focused instruction.

These important mediating or moderating conditions raise more questions about the professional community concept, namely whether characteristics such as trust, professional support for learning and shared leadership, should be considered either as school conditions or as professional community sub-dimensions in this research field. To stress the necessity of answering these questions, chapter 4 indicated that some studies have measured particular internal and/or external school facilitators as parts of the professional community concept, especially of the professional learning community concept (e.g. Reichstetter & Baenen, 2007; Thomas, 2010), whereas other authors considered them as external facilitators (e.g. Ingvarson, Meiers, & Beavis, 2005, Louis, Dretzke, & Wahlstrom, 2010). In the case of the *professional learning community* concept, there is a general tendency nowadays toward including these conditions in its definition and operationalization, such as the role of leaders and non-teaching staff (e.g. Bolam et al., 2005; DuFour, Eaker, & DuFour, 1998). This elaboration expands the discussion whether the *professional community* and the *professional learning community* concepts should be used as derived constructs or should take different development paths.

Final conclusion

Our results, based on the information provided by teachers from different domains, such as mathematics, Dutch language and English language, have added a promising new spectrum of insights into the specifics of professional community practices. In Dutch secondary schools, professional community proved to have mainly the following features: *reflective dialogue* - represented by teachers who meet to discuss issues such as the development of a new curriculum or the goals of the school and the management of their classrooms, always with a focus on improving student learning; and *collective responsibility* - which implies that in taking responsibility as a team for the proper functioning of the organization, teachers focus on the school as a whole rather than only on their classrooms. Considering that the Dutch secondary schools only moderately represent the professional community principle,

more is yet to be expected from these schools in adopting and further develop professional community practices.

With respect to the influence of professional community on student achievement in Dutch secondary schools, it can be concluded that the total direct effect has proved to be small. Therefore, the results of this thesis have opened the door to a whole new spectrum of follow-up research, taking into consideration a range of new perspectives, such as the role of school conditions and the differences among educational tracks.

SAMENVATTING.

Professionele gemeenschap en leerlingprestaties

Samenvatting

Professionele gemeenschap en leerlingprestaties

Het concept van de professionele gemeenschap heeft de afgelopen dertig jaar in theorie en praktijk duidelijk aan terrein gewonnen (Nehring & Fitzsimons, 2011). De conceptualisering ervan bleek echter problematisch en de veronderstelling dat het een positieve relatie heeft met leerlingprestaties vereiste empirische onderbouwing. Dit proefschrift heeft zich daarom gericht op het verhelderen van de definitie van het concept van de professionele gemeenschap en op het opnieuw onderzoeken van het beschikbare empirische bewijs dat de veronderstelling van een positief verband met de leerlingprestaties op middelbare scholen ondersteunt. Daarnaast fungeerde het operationaliseren en meten van het concept in een Nederlandse middelbare schoolomgeving als een test om te bepalen of de professionele gemeenschap ook in deze onderzoekscontext toepasbaar is en of er ook hier een samenhang bestaat met leerlingprestaties.

In het kader van deze empirische doelstelling zijn voor dit proefschrift drie hoofdonderzoeksvragen geformuleerd:

1. Hoe wordt het concept van de professionele gemeenschap gedefinieerd en geoperationaliseerd?
2. Hoe kunnen het concept en zijn sub-dimensies worden gemeten en gevalideerd?
3. Bestaat er een verband tussen professionele gemeenschappen en leerlingprestaties op middelbare scholen?

In de volgende paragraaf wordt eerst een samenvatting gegeven van de uitkomsten van de vier uitgevoerde studies, gevolgd door de antwoorden op de drie onderzoeksvragen.

Samenvatting van de belangrijkste conclusies per studie

Hoofdstuk 1 biedt een overzicht van de ontwikkeling van de professionele gemeenschap door de jaren heen. Centrale thema's zijn de processen van het definiëren, operationaliseren en meten van het concept. Vervolgens wordt een samenvatting gegeven van het empirische bewijs voor het verband tussen de professionele gemeenschap en leerlingprestaties op middelbare scholen. Vanaf de jaren '80 van de vorige eeuw, toen de eerste studie over deze relatie verscheen (Little, 1982), tot op heden, heeft de ontwikkeling van het concept drie specifieke fasen doorlopen: de *definiëringsfase* (1982-1994), de *operationaliserings- en meetfase* (1995-2005) en de *invoerings- en voorwaardenfase* (2005-2009). Op basis van de constructen *collegialiteit* en *samenwerking* nam professionele gemeenschap vanaf de jaren '90 de vorm aan van een multidimensionaal concept, waarbij de term inwisselbaar was met 'professionele leergemeenschap' en ook vaak in verband werd gebracht met andere concepten. Hoofdstuk 1 wordt afgesloten met het geven van de meest gangbare definitie van het concept van de professionele gemeenschap.

Hoofdstuk 2 is in het bijzonder gericht op de problemen met betrekking tot het formuleren van een universele definitie van de professionele gemeenschap en de operationalisering ervan. Om meer licht op deze onderwerpen te werpen, hebben we het huidige theoretische en empirische bewijs in de literatuur onderzocht. Verklaringen voor de vraag waarom het, zowel in conceptueel als methodologisch opzicht, zo lastig is om grip te krijgen op de professionele gemeenschap liggen onder meer in de verschillende gebruikte theoretische uitgangspunten, de alomvattendheid van de erin geïntegreerde concepten *professionaliteit, leren* en *gemeenschap* (Toole & Louis, 2002) en het grote aantal verschillende termen dat in samenhang met het concept wordt gebruikt, zoals collegialiteit, samenwerking tussen leerkrachten, netwerken, kennisgemeenschappen enzovoorts. Rond 1995 werd het begrip professionele gemeenschap losgekoppeld van verwante concepten en gedefinieerd en geoperationaliseerd vanuit een multidimensionale benadering gebaseerd op vijf onderling samenhangende sub-dimensies: *reflectieve dialoog, praktijkdeprivatisering* of *feedback op onderwijs, gezamenlijke activiteit, gedeelde doelgerichtheid* en *gerichtheid op het leren van de leerling*. Daarnaast is een meta-analyse uitgevoerd om de relatie tussen de professionele gemeenschap en leerlingprestaties op middelbare scholen te onderzoeken. Uitvoerig literatuuronderzoek en afzonderlijke berekeningen uitgevoerd op de vijf sub-dimensies resulteerden in variërende effectgroottes in termen van Cohens *d*, van kleine tot gemiddelde positieve effecten (bijv. .22 in Lee & Smith, 1996; .56 in Louis & Marks, 1998), met een significante (gewogen) gemiddelde effectgrootte van .25 en een betrouwbaarheidsinterval van 95% die de nullijn niet kruiste. Uit deze resultaten kan worden geconcludeerd dat de relatie tussen professionele gemeenschappen en leerlingprestaties op middelbare scholen positief en significant is, met een kleine maar relevante effectgrootte.

Omdat middelbare scholen zijn verdeeld in vakgroepen (McLaughlin & Talbert, 2001; Witziers, 1992), wordt in hoofdstuk 3 onderzocht in welke mate het principe van de professionele gemeenschap wordt toegepast in een aantal vakgroepen wiskunde en wat dit betekent voor de leerlingprestaties. De belangrijkste resultaten, gebaseerd op een steekproef onder 130 leerkrachten op 130 scholen, tonen aan dat professionele wiskundegemeenschappen relatief goed ontwikkeld zijn. In meer detail: 73% van de leerkrachten gaf aan dat hun manier van werken werd gekenmerkt door tenminste een van de vijf sub-dimensies van een professionele gemeenschap. *Een gedeelde doelgerichtheid* en *gerichtheid op het leren van de leerling* werden genoemd als de meest toegepaste werkwijzen, gevolgd door de *reflectieve dialoog*. *Praktijkdeprivatisering* bleek de minst voorkomende activiteit van de leerkrachten binnen de vakgroepen wiskunde. Verder had alleen *gerichtheid op het leren van de leerling* een significante en positieve relatie met de prestatiescores van 2.706 leerlingen, met een kleine effectgrootte van .24. Bij indeling van de scholen in categorieën op basis van de sterkte en de frequentie van de vijf sub-dimensies binnen de vakgroepen wiskunde, konden 40 (34%) worden aangemerkt als *professionele-gemeenschapclusters*. Deze categorie vertoonde de hoogste leerlingprestatiescores in vergelijking met scholen gericht op *gezamenlijke activiteit* (28%), scholen gericht op *praktijkdeprivatisering* (11%) en scholen gekenmerkt als *niet-professionele gemeenschappen* (27%). Voorts lieten alleen *professionele-gemeenschapclusters* een significant en positief verband zien met de wiskundecijfers van de leerlingen (een effectgrootte van .20), waardoor de vakgroepgerichte professionele gemeenschap naar voren kwam als relevante voorspeller. Deze resultaten bleken los te staan van de verschillende types scholen die in de steekproef werden gebruikt, namelijk VMBO en HAVO/VWO, en werden verkregen na toetsing met leerling-, leerkracht- en schoolcovariabelen.

In hoofdstuk 4 worden de operationalisering van het concept en de afbakening van de belangrijkste sub-dimensies ervan behandeld. In het chronologische overzicht van de ontwikkeling van de professionele gemeenschap geven we een opsomming van de instrumenten voor het meten van het concept, verkregen uit meer dan 60 artikelen. We hebben acht meetinstrumenten geselecteerd en deze geanalyseerd op basis van specifieke criteria. De index *Professionele Gemeenschap van Leerkrachten* (15 onderdelen, 4 sub-dimensies) van Wahlstrom en Louis (2008, p.487) voldeed het beste aan de meeste analysecriteria. Na enkele specifieke aanpassingen van dit instrument bevatte ons definitieve te valideren instrument vier sub-dimensies van de professionele gemeenschap: *praktijkdeprivatisering, reflectieve dialoog, gezamenlijke verantwoordelijkheid* en *gerichtheid op het leren van de leerling*. De empirische resultaten van onze bevestigende factoranalyses van de eerste en tweede orde, met kruisvalidatie op twee gestratficeerd getrokken substeekproeven onder respectievelijk 102 en 95 leerkrachten, gaven echter duidelijk aanleiding tot het opnemen van slechts drie sub-dimensies van de professionele gemeenschap. Dit betekende dat het kenmerk *gerichtheid op het leren van de leerling* buiten beschouwing werd gelaten. Deze

uitkomst resulteerde in het *Professionele-gemeenschapsinstrument* (12 onderdelen, 3 sub-dimensies), dat succesvol werd gevalideerd in de context van het Nederlandse onderwijs.

Om de specifieke kenmerken van de professionele gemeenschap verder te onderzoeken, wordt in hoofdstuk 5 de kracht van professionele gemeenschappen binnen Nederlandse middelbare scholen op schoolniveau onderzocht, op basis van de drie gekozen sub-dimensies en hun relatie met leerlingprestaties.

Op basis van de ervaringen van 157 leerkrachten werkzaam op 41 scholen kon worden vastgesteld dat de frequentie waarmee activiteiten op het gebied van de sub-dimensies *reflectieve dialoog* en *gedeelde doelgerichtheid* werden uitgevoerd, matig tot laag was. Ook als deze twee sub-dimensies werden beschouwd als kenmerken op schoolniveau kwamen zij - zoals werd aangegeven - met een matige frequentie voor, welke overigens hoger was dan die van *praktijkdeprivatisering*. Uitgaande van de op schoolniveau geaggregeerde gegevens betreffende de professionele gemeenschap zijn de scholen werden voorts onderverdeeld in verschillende clusters: *Professionele-Gemeenschapscholen* (27%), *Reflectieve-Dialoogscholen* (44%) en *Niet-Professionele-Gemeenschapscholen* (29%). De veronderstelde positieve relatie tussen de professionele gemeenschap en leerlingprestaties werd alleen voor het VWO bevestigd, en niet in de andere schoolsoorten VMBO en HAVO. Nader beschouwd bestaat er een positief en significant verband tussen de professionele gemeenschap gemeten als geheel overkoepelend concept en leerlingprestaties, met een significante effectgrootte van .20. Daarnaast hebben de sub-dimensie *reflectieve dialoog* (effectgrootte .24) en het cluster *reflectieve-dialoogscholen* (effectgrootte .18) een significante relatie met de leerlingprestaties in het VWO. In VMBO-GL+TL bleek de relatie tussen de professionele gemeenschap (de totale schaal, de *sub-dimensie gedeelde doelgerichtheid* en het *schoolcluster Professionele Gemeenschap*) en leerlingprestaties echter negatief te zijn. Concluderend kan worden gesteld dat slechts een klein aantal positieve significante effecten zijn gevonden, hetgeen onvoldoende grond bood ter ondersteuning van de hypothese van een positieve relatie op Nederlandse middelbare scholen.

Algemene antwoorden op de onderzoeksvragen

Hoe wordt het concept van de professionele gemeenschap gedefinieerd en geoperationaliseerd?

Het antwoord op de eerste onderzoeksvraag luidt dat het concept van de professionele gemeenschap een multidimensionaal karakter heeft, hetgeen betekent dat het bestaat uit meer dan één onderliggende sub-dimensie. Ook al is het voor onderzoekers moeilijk gebleken om het eens te worden over de vraag uit welke sub-dimensies het concept nu precies bestaat, zoals we zagen in hoofdstuk 2, het wordt doorgaans gedefinieerd en geoperationaliseerd

aan de hand van vijf sub-dimensies, te weten *reflectieve dialoog, gezamenlijke activiteit, praktijkdeprivatisering, gedeelde doelgerichtheid* en *gerichtheid op het leren van de leerling*. Deze multidimensionale zienswijze is weliswaar niet de enige mogelijke definitie van het concept, maar zij maakt het wel mogelijk om het van andere verwante concepten te onderscheiden. Op middelbare scholen wordt de professionele gemeenschap − beschouwd als kenmerk van een vakgroep of school − gedefinieerd als multidimensionaal concept.

Hoe kunnen het concept van de professionele gemeenschap en zijn sub-dimensies worden gemeten en gevalideerd?

Louis stelt dat het concept van de professionele gemeenschap is aangeland in een stadium van 'kakofonie en herbezinning', waarbij onderzoekers zich moeten herbezinnen op de verschillende benaderingen van het concept en tot consensus moeten komen over de vraag hoe het moet worden gemeten (Louis, AERA, 2011). Uit de uitvoerige bespreking in hoofdstuk 4 blijkt dan ook dat het meten van de professionele gemeenschap de afgelopen dertig jaar heeft plaatsgevonden met behulp van verschillende instrumenten waarin een of meer van de vijf sub-dimensies waren geïntegreerd. Bij de ontwikkeling en het testen van een dergelijk instrument in het Nederlandse onderwijsstelsel, werd het multidimensionale karakter van professionele gemeenschap slechts gedefinieerd aan de hand van drie sub-dimensies: *reflectieve dialoog, praktijkdeprivatisering* en *gezamenlijke verantwoordelijkheid*. Het antwoord op bovengenoemde onderzoeksvraag is dat het concept van de professionele gemeenschap met meer dan één sub-dimensie dient te worden gemeten om het multidimensionale karakter ervan te kunnen vangen, wat empirisch bewijs oplevert voor het onderscheidend bestaan van de onderliggende sub-dimensies *reflectieve dialoog, praktijkdeprivatisering* en *gezamenlijke verantwoordelijkheid*.

Voorts tonen onze bevindingen aan dat *gerichtheid op het leren van de leerling* niet zozeer een expliciete sub-dimensie van het concept is maar in feite het onderliggende einddoel ervan, door de leerkrachten ervaren als de overkoepelende betekenis en inhoud van hun samenwerkingspraktijk (Sigurðardóttir, 2010; Timperley, 2008).

Bestaat er een verband tussen professionele gemeenschappen en leerlingprestaties op middelbare scholen?

In beginsel liet de meta-analyse met betrekking tot de relatie tussen de professionele gemeenschap en leerlingprestaties op middelbare scholen een (gewogen) gemiddelde effectgrootte van .25 zien, een kleine effectgrootte in termen van Cohen (1989). Het positieve verband tussen professionele gemeenschappen en leerlingprestaties wordt in hoofdstuk 5 in het bijzonder bevestigd (effectgrootte .20) voor het VWO. Tijdens het onderzoek naar de effecten van de onderliggende sub-dimensies van de professionele gemeenschap liet

de *gerichtheid op het leren van de leerling* een positieve en significante relatie zien met leerlingprestaties in vakgroepgerichte professionele gemeenschappen (effectgrootte .24) en de *reflectieve dialoog* in schoolgerichte professionele gemeenschappen (effectgrootte .24) voor het VWO.

Scholen gekarakteriseerd door sterkere wiskunde-vakgroepen wat betreft de uitoefening van activiteiten in het kader van de professionele gemeenschap bleken hogere leerlingprestaties op het gebied van wiskunde te hebben. Deze bevinding had echter geen betrekking op professionele gemeenschappen op schoolniveau, waar het concept met een lage frequentie voorkwam. En hoewel op sommige scholen de frequentie van deze activiteiten wel hoger was, bleek er geen sterke relatie te zijn tussen het vóórkomen van professionale leergemeenschappen en leerlingprestaties.

Slotconclusie

Onze resultaten, gebaseerd op informatie verstrekt door leerkrachten uit verschillende vakdomeinen, zoals wiskunde, Nederlands en Engels, hebben een veelbelovend scala aan inzichten opgeleverd met betrekking tot de specifieke kenmerken van activiteiten gerelateerd aan het concept van de professionele gemeenschap. Op Nederlandse middelbare scholen kwamen deze activiteiten voornamelijk voor in de vorm van de *reflectieve dialoog*: het samenkomen van leerkrachten om zaken te bespreken zoals de ontwikkeling van nieuwe curricula, de doelstellingen van de school, of de inrichting van het onderwijs per klas, waarbij steeds het accent lag op een verbetering van de leerlingprestaties. Andere activiteiten hadden betrekking op de sub-dimensie *gedeelde doelgerichtheid*, hetgeen aantoont dat door in teamverband verantwoordelijkheid te nemen voor het goed functioneren van de organisatie, de nadruk meer lag op de school in zijn geheel dan op het onderwijs op vakgroepniveau. Gezien de matige frequentie van activiteiten in het kader van de professionele gemeenschap op Nederlandse middelbare scholen, zullen deze organisaties meer inspanningen moeten gaan leveren op dit gebied.

Met betrekking tot de invloed van de professionele gemeenschap op de leerlingenprestaties op Nederlandse middelbare scholen kan worden geconcludeerd dat het totale directe effect klein is. Deze bevinding heeft de deur geopend naar een geheel nieuw spectrum van vervolgonderzoek gebaseerd op een scala aan nieuwe invalshoeken, zoals de rol die schoolomstandigheden spelen en de verschillen tussen de onderwijstrajecten.

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Curriculum vitae.

Related publications.

Published work

Lomos, C., Hofman, R.H., & Bosker, R.J. (2011). Professional community and student achievement – a meta-analysis. *School Effectiveness and School Improvement*, *22*(2), 121-148. (1.150 - 5-year impact factor)

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Lomos, C., Hofman, R.H., & Bosker, R.J. (under review). *Conceptualization, measurement and validation of the professional community concept.* Submitted.

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Lomos, C., Hofman, R.H., Bosker, R.J. (2011). *Conceptualizing and measuring professional community*. Symposium presented at American Educational Research Association (AERA) conference, New Orleans; together with Karen Seashore (Louis), USA; Sally M. Thomas, UK; and Louise Stoll, UK

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